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Event and Comment.

A National Farming Policy.

FOLLOWING is a brief summary of the first report of the Rural Reconstruction Commission, in which the problems associated with the formulation of a national farming policy are reviewed in a general way:—

The Commission believes that the provision of electricity would do more to bridge the gap between city and country life than any other single factor. Although there are difficulties, it believes that it should be a national objective to give every farm which is not too remote the opportunity to use electricity at a cost comparable with that in the cities. It considers that the minimum household equipment should include, in addition to well-ventilated rooms of reasonable size, a reliable water supply; a kitchen sink with water laid on; adequate cooking facilities; a bathroom and a wash-house; and satisfactory arrangements for food storage. The report also suggests consideration of mass production of refrigerating equipment by the Commonwealth.

The Commission agrees that the principle of wage fixation is an essential step in the agricultural development of Australia.

Better Education.

THE Commission states that criticism of the present system of education may be grouped under three headings, viz.:—

1. Inadequate opportunities for many country children to obtain education at more than a low standard.
2. Education is insufficiently related to the realities of farm life.
3. Inadequate education in technical farming matters.

These criticisms demand a reorganization of the school system in country districts, and adult education also needs careful consideration.

The Commission considers that organization and equipment of health services in some regions should be improved. A co-ordinated scheme of base hospitals and district hospitals, with adequate equipment and staffs and including maternity and bush-nursing institutions, is necessary.

It recommends that more attention should be given to the scientific survey of the soils of areas regarded as desirable for land settlement. Settlement of any area should not be planned until the suitability of the soil for the intended type of farming has been determined.

Water Schemes.

THE Commission expresses the opinion that very careful consideration should be given to any proposal for the diversion of water which might ultimately be required for agriculture. If it is accepted that the cost of providing large head-works should be a Commonwealth or State matter, the nation should reserve the right to decide in large measure the use to which the water is to be put.

It should be a long-range objective to foster a gradual increase in the size of farms where necessary, until they are large enough to warrant mechanization to facilitate relatively low-cost production and fair returns

Land Values.

DEALING with land values, the report states that people should not be called on to pay high prices for foodstuffs because land is held for speculative reasons. The terms of leases and share-farming agreements require investigation, as in many cases they lead to low-grade farming and exploitation.

There is need for greater foresight into the financial stability of farming in the future, the report adds. There seems little to be said for asking the taxpayer to provide money to liquidate debts incurred by unwise borrowing without, at the same time, taking action to reduce the chances of a recurrence of such a crisis. The provision of credit for schemes of rural development requires careful consideration.

War Agricultural Committees in Britain.

SOME interesting facts on wartime farming in Britain were given recently to a gathering of primary producers' representatives and other citizens in Brisbane recently by a visiting authority on present-day British agricultural economy. At the outbreak of war, he said, England had 11,000,000 acres under the plough and just twice as much under grass. Britain is now probably the most highly mechanized country in the world, with 18,000,000 acres under the plough and 15,000,000 acres under grass. Realising that Britain would have to depend largely on her own agriculture for essential foodstuffs, a war agricultural committee of leading district farmers was appointed in every county under the guidance of the Ministry of Agriculture. Every farm in the land was subsequently graded as A, B or C, the "A" farms being those which were well managed, and the "C" grade those on which standards of production had, willy-nilly, to be raised. As the organization developed and after rural wage adjustments and increases had been determined, it was decided by the Government that no one was to leave the industry without permission. In addition, the Women's Land Army—now with a membership of 80,000—was organized for a nation-wide food production service. School holidays were arranged to coincide with harvesting, so that every available boy and girl might assist; local business people were also co-opted for urgent farm work when needed. As a result of intense organization and a realistic handling of production problems, the harvests of the last three years have broken all pre-war records.

Fodder Conservation.

C. J. McKEON.

FODDER conservation in the form of silage has been practised in Queensland for many years, but the annual aggregate storage has been far below ordinary winter requirements, apart altogether from drought reserves which should be stored in seasons of abundance. Soil and climatic conditions throughout the agricultural districts of Queensland are generally favourable for the production of many summer fodder crops, which provide a great bulk of material suitable for silage making. Hence, if full advantage were taken of the bounty of nature, stock losses during seasons of scarcity would be greatly reduced. In addition to its drought insurance value, however, silage provides a succulent and nutritious winter stock food at a time when natural pastures are usually dry, unpalatable, and lacking in nutritive value. It has been proved that the feeding value of silage is little, if at all, inferior to that of the green material from which it was made, and this, coupled with the fact that its succulence and laxative properties promote a better functioning of the digestive system than dry feed, makes it a very valuable fodder.

Winter rainfall is usually unreliable in most districts in this State; consequently the planting of seasonal crops for grazing purposes cannot be undertaken with any certainty that they will provide sufficient food to enable stock to winter well. Summer fodder crops, however, can be sown with far greater confidence, and from them a much greater bulk of green material can be produced.

During the early years of the development of dairy farming in Queensland, especially on the fertile soils of the rain-forest districts, the growth of sown pastures was so luxuriant that the need for fodder conservation was not felt. The rate of stocking was then considerably higher than that of later years. The gradual decline in the carrying capacity of even the richest lands through the lowering of soil fertility, through soil impaction caused by heavy stocking, and through the old swards becoming root-bound has since made fodder conservation a necessity in the majority of holdings in every dairying district.

The same serious reduction in carrying capacity has also occurred in native pastures largely as a result of over-stocking. The stock naturally show a preference for the more nutritious and more palatable native grasses, with the result that they have been kept in a closely-grazed condition and been prevented from seeding. The inferior species

have been neglected to a large extent, and, consequently, have seeded freely and ultimately predominated in some cases.

For the reasons just given, a silo is really a necessity on most properties in agricultural areas. It is a very definite asset, and it is doubtful if the outlay involved could be expended on any other improvement with greater financial benefit. The increased butter production alone resulting when dairy cows are fed on silage during the winter months of normal seasons would soon compensate for the expenditure involved. In addition, a well-filled silo would be the means of saving at least a portion of a herd during drought periods, when the cost of fodder precludes its purchase by many stockowners.

Admittedly many are not in a financial position to build the more costly types of silo, but if it were more widely appreciated how effectively and cheaply silage can be conserved in the less costly silos it would be used to a much greater extent than it is at present.

The making of silage is not a complicated process calling for considerable skill and experience. The reverse is the case, less skill and experience being required than for the making of good hay. Furthermore, the best quality silage can be made during weather conditions which would make the curing of hay impossible. Once a crop has reached the correct stage for converting into silage a start can be made regardless of the weather and, providing a few simple rules are observed, silage of good quality can be made by anyone who has had no previous experience.

The Making of Silage.

Good quality silage can be made only from material which has been cut and stored in a fresh, green state, the aim being to conserve the fodder in a succulent condition. This is brought about by acid fermentation which occurs when the air is excluded from the mass; consequently, the quality of the silage will be very largely influenced by the extent to which the air has been expelled and excluded from the material. It is therefore necessary that the silo be as airtight as possible.

The best quality silage is that known as "acid" silage, which is light-brown to yellow-brown in colour and possesses a distinctly pleasant acid smell—hence the name. Silage of this kind can be made only from suitable types of crops, and then only when these have been cut at the right stage of growth and handled in the correct manner. If crops have been allowed to reach an advanced stage of maturity, or if they have been allowed to dry out in the field after being cut, normal fermentation will not occur, moulds will develop, and an inferior silage, known as "mouldy" or "musty" silage, will be the result. Crops which would otherwise be suitable, but which have been cut when very immature, or which are naturally of a very soft succulent nature, also make an inferior silage when used alone, for the soft, sappy material packs so closely that little heating takes place. Silage made under these conditions possesses an objectionable smell and is known as "sour" silage. Immature material or material of too succulent a nature may be used, however, to advantage by blending with material of a coarse and more fibrous nature, such as maize or sorghum. The proportions in which it should be blended, with either of the latter crops, depend upon its degree of immaturity or succulence, but, as a general rule, it should not be mixed in more than equal proportions.

The material should be cut when in a green, but not immature, stage, and should be carted from the field and placed in a silo as soon as possible after being cut. On no account should it be allowed to lie in the hot sun and become badly wilted. Should this occur for some unavoidable reason, it is advisable to sprinkle the material with water as it is being conveyed to the silo from the cutter. If, however, the quantity of material so affected is large, it should be mixed in equal proportions with freshly-cut material when being stored, and, if necessary, also sprinkled with water.

Silage which has been properly made will keep for many years without deteriorating in any way if stored under airtight conditions. It is not damaged in any way by insects or vermin, nor is there any risk of loss by fire as is the case with hay.

The Feeding of Silage.

If required, silage may be fed from eight to ten weeks after being made. Stock quickly acquire a taste for it and greatly relish silage, and rarely is any trouble experienced in getting them accustomed to it. When it is intended to feed it to dairy cows that have not previously had silage, it is a good practice to place a small quantity in feed boxes at the head of each bail for a few days before commencing regular feeding. When this is done, the cows almost invariably acquire a taste for it within a few days.

Silage is not only a nutritious and palatable food for dairy cows but it is also excellent for sheep, and during winter months or dry periods, it is of particular value for breeding ewes. It is not generally regarded as being suitable for horses; they will eat it, but it should be fed sparingly to them.

It is advisable to commence feeding a small ration, gradually increasing the quantity until the full ration is being fed. This particularly applies to stock which have been on dry feed and which are likely to be affected by scouring if a full ration were fed from the commencement. The amount of silage to be fed daily is governed by the weight of the animal and the quantity and quality of milk produced, in the case of dairy cattle, as well as by the amount of natural feed available.

Silage made from crops such as maize and sorghum, which are those most widely used for this purpose, contains a high proportion of carbohydrates, but it does not contain sufficient protein to constitute a balanced ration. Therefore, when fed to dairy cows with a view to maintaining or increasing milk production, silage should be supplemented by protein rich food, such as lucerne, cowpea, field pea, seed cake preparations, and meat meals.

Suitable Silage Crops.

The best silage is made from crops with a high sugar concentration, as these form sufficient acid to ensure the desired state of preservation. Legumes are unsuitable for silage-making alone unless strong preserving acid or fermenting molasses is added. As a general rule, these crops are better conserved as hay. The chief crops produced in Queensland for silage purposes possess the desired sugar content and, in addition, produce a large quantity of green material.

Maize is the most popular and also the most suitable of all crops for silage purposes. To facilitate harvesting and also to promote good

cob growth, it should be sown in rows just sufficiently wide to permit of inter-row cultivation. It may also be spaced closer in the rows than when the crop is grown for grain. The crop should be cut when the grain is well formed but before it has commenced to harden. The ideal stage is when the grain reaches the late dough stage. The cheapest and most efficient method of harvesting maize for silage-making is with a maize binder, but few of these very efficient labour-saving machines are now to be seen and the crop is usually harvested by hand, using a cane knife or other suitable tool.

Improved Yellow Dent, also known as Fitzroy, Golden Beauty, and Star Leaming are varieties which can be recommended as silage crops. The first mentioned is suitable only for coastal districts where the rainfall is generous and reliable, whereas the other two varieties can be grown both on the coast and inland. On good soils and under favourable seasonal conditions, yields of from 12 to 15 tons of green material to the acre may be expected.

Sorghums (Plate 103) are next in favour for silage-making and are particularly suitable for districts in which the rainfall is light or unreliable. They can also be grown successfully on poorer types of soil, which are not suitable for maize. The saccharine types are recommended in preference to the grain types, as the stalks of the latter are of a pithy nature and have a low sugar content.

The commonest practice is to sow these silage sorghums broadcast, but many arguments can be advanced in favour of sowing them in rows, spaced either just wide enough apart to permit of inter-row cultivation or sufficiently close to enable the plants to suppress weed growth. When the closer spacing is adopted, a seed drill should be used for sowing the seed, and a very satisfactory row spacing can be attained by blocking every second grain run, thus spacing the drills 14 inches apart.

Plate 103.

SACCHARINE SORGHUM CROP SUITABLE FOR SILAGE.

Crops sown in rows are handled with greater ease and celerity and are less likely to lodge and become a tangled mass than when sown broadcast. This is particularly important when the full length stalks are to be used, as in trench silos and stack silage, because bent and twisted stalks cannot be stored so compactly as straight stalked material. The crop should be cut when the grain is in the same condition as that recommended for maize silage. The same methods of cutting the crop are also usually adopted.

The most widely-grown varieties are Imphee or Planter's Friend, Saccaline, and Honey. Other varieties are White African, Sugardrip, Orange, Italian, Colman, and Sumac. Under favourable conditions, yields of up to 20 tons to the acre may be expected, and this figure may be exceeded under very favourable conditions.

Sudan grass also makes excellent silage and is a crop which is particularly suitable for inland districts. It may be used alone or in conjunction with the coarser stalked crops, such as maize. When made into silage with full length maize stalks in either trenches or stacks, the fine stalks of the Sudan grass pack closely between the coarser maize stalks, thereby assisting in expelling the air as the mass of material settles.

If available, a seed drill should be used for sowing Sudan grass, but, if not, the seed should be sown broadcast. The best method of cutting the crop is with an ordinary reaper and binder, as material so cut is more easily handled, both in the field and when being placed in the silo, than crops which are cut with a horse mower. The correct stage for cutting is when the grain is just forming. Given favourable weather conditions, two or more cuttings of Sudan grass may be expected. From a well-grown crop a first cut of 8 to 10 tons of green material to the acre may be produced. Any subsequent cutting is usually much lighter.

White panicum and Japanese millet, which are fairly extensively grown for hay and grazing, are also of considerable value for silage-making, being converted into silage either alone or as a mixture with maize or sorghum. They can be grown successfully on a fairly large range of soils but are not so well suited to such districts as the Darling Downs and the Maranoa as is Sudan grass. For coastal districts the reverse is the case. They are sown and cut in the same way as Sudan grass, but the yields of green fodder are somewhat lighter. Cutting should be carried out before the grain has developed. They are free seeders and shed their seed readily and should, therefore, not be allowed to produce mature seed; otherwise a considerable amount of trouble will be experienced in dealing with the volunteer growth which will appear the following season.

The foregoing crops are the most widely grown and also the most suitable for silage purposes, but, in addition, other summer-growing crops, such as cow cane and elephant grass, produce a great bulk of fodder and may be successfully used if cut before the stalks become too woody, particularly if a light-stalked crop is mixed with them. Pasture grasses, such as paspalum and Rhodes grass and others of a similar habit of growth, may also be cut for silage, but when these are being used alone, i.e., not as a mixture with heavier-stalked crops, they should be cut when in a fairly mature, but not dry, stage, and on no account should they be used for silage in a young stage. If this were done, the best

that could be expected would be sour silage, and very often the resultant material would turn out an almost worthless sodden mass.

Legumes such as lucerne, Poona, Black, and Groit cowpeas are rarely used alone in Queensland for silage-making, but are frequently mixed with non-leguminous crops, thereby increasing the feeding value of the silage. Lucerne is easily cut and handled and presents no difficulties in this respect, but owing to their habit of growth, cowpeas are much more difficult to cut and handle, and, consequently, they are not used to the extent they might otherwise be. Some success has been met with when cowpeas and maize or sorghum have been grown together, but such a combined crop is usually difficult to handle, and furthermore, a heavier yield is generally obtained when the two crops are grown separately. Nevertheless, a combination of Groit cowpea and maize has proved promising on the Atherton Tableland. A light sowing of the cowpeas can be made, the seed being sown in the same drills and at the same time as the maize. No general recommendation can be made regarding cowpea varieties for silage, as soil fertility and seasonal conditions have such a marked influence on the growth and period of maturity. The aim should be to select a variety of cowpea that will produce the desired amount of foliage and reach the correct stage for cutting at the same time as the maize. It should not, however, be a variety which will produce a crop of vines sufficiently heavy to restrict the growth of the maize or weigh the plants down and thus add to the cutting and handling costs.

Winter-growing crops which may be used for silage-making are wheat, barley, oats, and field pea. Florence wheat and Dun field pea, when sown together at the rate of 40 lb. of the former and 20 lb. of the latter to the acre, provide an excellent mixture, as both crops reach the correct stage for cutting, i.e., the flowering stage, at the same time. Other winter cereals, when sown in conjunction with field pea, also give very good results. The growing of winter crops cannot be undertaken with the same degree of certainty as in the case of summer crops, nor are their yields of green material comparable with those from summer crops, such as maize or sorghum. Hence the growing of these or other suitable summer crops, in preference to winter crops, is recommended.

Tower Silo.

The reinforced concrete tower silo (Plate 104) is usually the most costly type to construct, and, in addition, a more expensive plant is required to fill it than is necessary for an underground silo. The points in favour of the tower silo, however, outweigh those objections, and for anyone who is in a financial position to build one, this type of silo is strongly recommended. If properly constructed it is practically everlasting.

The best results are obtained when the silo has been so constructed that the height is considerably greater than the diameter, thereby ensuring sufficient pressure to consolidate the materials properly. The usual practice is to make the height of the silo approximately double the diameter of the silo, e.g., a silo 14 feet in diameter should be 28 feet in height. Should it be desired to reduce the height of the silo above ground, this can be done by excavating and building a portion underground. The cost of construction varies very considerably, and is influenced largely by the distance that materials, particularly sand and metal or river gravel, have to be carted and the amount of outside labour required.

In addition to an engine and cutter, which is required for chaffing the material to be converted into silage, either a blower or an elevator is necessary to convey the chaffed material to the silo. The latter calls for additional power, and an engine of at least 5 horse-power is required to drive the cutter and at the same time provide the necessary power to work the blower or elevator.

Plate 104.
Reinforced Concrete Twin Tower Silo.

Filling the Tower Silo.

During the whole time filling operations are in progress one person should be stationed inside the silo to keep the chaffed material evenly distributed and well trampled, paying particular attention to the material adjacent to the wall. As the chaffed material is falling from the top of the silo, the heavier particles drop in the centre, and the light, leafy portions drift towards the wall. It is therefore essential that constant attention be paid to the even distribution of the material. On no account should this be done at lengthy intervals, as it will not then be possible to get an even mixing, with the result that an uneven consolidation will occur and the quality of the silage will be adversely affected.

As a greater settling occurs in the centre of the silo than elsewhere, it is advisable to keep the material slightly higher in the centre. When filling has ceased for the day, all who are assisting with the work should enter the silo and thoroughly trample the material. Filling should be continued each day until the silo has been filled. Should operations be unavoidably held up, the top layers of material will quickly deteriorate if left exposed to the air, and should it be evident that any more than a few days will elapse before it will be possible to resume filling operations, it is advisable to cover the material with a layer, several inches in depth, of finely-chopped succulent grass or something equally suitable. The covering layer should be removed immediately prior to filling being resumed, care being taken to see that no material showing signs of mould is left. The same care is necessary where a protective covering has not been used, as it will then be necessary to remove the top layers of the

material which is being converted into silage and which have become dry or are showing signs of mould.

When the silo has been filled, a layer of approximately 12 inches in depth of some fine-stalked, succulent material should then be added and spread evenly over the surface as soon as possible. When well trampled, this forms a dense, mouldy mass and prevents the entry of air. When suitable green material is not available, wet chaff may be used.

Weighting material is of great assistance in bringing about the desired consolidation of the top few feet of material, but it is not an easy matter to convey the required amount of earth or stones to the top of the silo and, rather than do so, many prefer to devote more time to the trampling of the top few feet of silage and also of the material which is used as a protective covering.

Plate 105.

CIRCULAR PIT SILO SHOWING CONCRETE COLLAR AND SLIDING ROOF.

Emptying the Tower Silo.

When it is intended to commence feeding the silage to stock, the covering material and with it the top layer of silage which has been in contact with the mass of mouldy covering material should be removed. If the material has been thoroughly trampled, the quantity of silage which has become mouldy will be negligible, and usually the removal of a layer an inch or two in depth is all that is necessary. Silage deteriorates when exposed to the air for any length of time, and each day's requirements should be taken from the whole of the surface to a depth of at least 2 inches. This prevents any remaining exposed for more than twenty-four hours. An ordinary garden rake is very suitable for removing the silage, as the surface can be maintained in an even condition and the layer below is not disturbed, as would be the case were a fork or other long-pronged tool used.

So little time is required each day in removing and replacing a cover that the use of one is recommended. This can be made from

canvas or any other suitable material, and will assist very materially in keeping the silage in a succulent condition.

Circular Pit Silo.

The circular pit silo (Plate 105) is becoming increasingly popular, and during recent years a very large number have been constructed. Providing a suitable site is available, it is not necessary to concrete the whole of the silo, and in such a case all that is required is a concrete collar 4 inches in width and 5 feet 6 inches in depth. The usual practice is to have portion of the collar projecting above ground level, and thus all risk of storm water finding its way into the silo is eliminated, and considerable protection is afforded against accident to human beings and straying stock. The collar type of circular pit silo would be unsatisfactory in many locations and, in such cases, it will be necessary for the whole of the pit to be concrete lined.

It is essential that the wall of the collar type of circular pit silo be kept plumb, and also that, below the collar, it be smoothly trimmed to ensure even settling of the material. Cavities in the wall will be the means of causing the silage adjacent to them to become mouldy or of inferior quality. By using an iron rod and batten, no difficulty should be experienced in keeping the wall plumb.

Providing the silo has been properly constructed on a site where there is no danger from water seepage, silage of the best quality can be made in the collar type of circular pit silo and kept for many years in splendid condition. The concrete collar type of circular pit silo can be more cheaply constructed than either the tower type or the completely concrete-lined circular pit silo, and the additional saving of the cost of a blower or elevator is effected, as compared with the tower type. The completely concrete-lined circular pit silo costs about the same as the tower silo, but here again the cost of a blower or elevator has not to be incurred. The removal of the silage from either type of circular pit silo, however, requires a little more time and labour than is the case with a tower silo, but for those who do not feel disposed to construct the latter type, the pit can be recommended as an efficient substitute.

Filling the Pit Silo.

The same methods should be adopted in every detail in filling a circular pit silo as when filling a tower silo. Weighting material to provide additional pressure may be applied with less inconvenience to the pit than to the tower silo. Furthermore, as the pit silo is covered either by a high shed or a low sliding roof, it is possible to thoroughly trample the material at a higher level in the silo than is the case with the tower silo, which of necessity has a fixed roof with little clearance between the top of the silo and the lowest portion of the roof.

Emptying the Pit Silo.

A hoist is necessary for the removal of the silage. The type of hoist, together with the self-emptying drum, which is recommended for use when excavating the pit has also proved highly satisfactory for the removal of the silage, and can be very cheaply constructed. The silage should be collected for removal in the same way as in the tower silo, and the same precautions should be adopted to keep the silage in a fresh, succulent condition.

Trench Silo.

Plate 106.
EXCAVATING A TRENCH SILO.

The trench silo (Plate 106) is a cheap and very efficient type, and is particularly suitable for inland districts where prolonged rainy periods are not generally experienced, and consequently the risk of seepage water gaining access to the trench is slight. Care is necessary in selecting a site, and one in which seepage is likely to occur should be avoided. The only cost involved in constructing a trench silo is for labour, and when the usual practice of excavating by means of a plough and scoop is adopted, the cost is small. Under normal conditions, and with a suitable plant, two men can excavate a trench of at least 50 tons capacity in two or three days. The excavation is usually 10 feet wide, approximately 8 feet deep, and whatever length is necessary to accommodate the material to be made into silage. The ends are sloped sufficiently to permit of the trucks or wagons being driven through the trench when unloading. The sides should be trimmed as evenly and as smoothly as possible. If logs are available, these should be laid along each side of the trench and the excavated earth banked over them to a height of approximately 2 feet. A gradual taper away from the trench should be allowed to prevent storm water gaining entry to the silage.

Filling the Trench Silo.

The material in a trench silo is usually made into silage in a whole or unchaffed state, and, in doing so, care should be taken to lay the stalks in one direction only. This applies particularly to thick, long-stalked crops, such as maize or sorghum, as the best results cannot be obtained with them when too much air is admitted as a result of careless spreading or laying the material in transverse layers. It should be spread in even layers, lengthwise along the trench.

The truck or wagon may be driven through the trench as each load is being spread. This allows the material to be handled more easily and more expeditiously than if it were unloaded from the side of the trench, and it also consolidates the silage. Filling (Plate 107) should

be continued until the material is well above the top of the trench to allow for subsidence. Should the material be likely to subside to such an extent that more is required, this may be added a week or ten days later. In the interval, a covering of green grass should be provided to prevent the formation of mould on the top layer. When the trench has been filled, a thick layer of green grass should be spread over the top of the silage material, and this in turn should be covered by earth excavated from the trench. The earth covering should be formed in such a manner that when the silage material has completely subsided there will be sufficient camber to turn rain water away from the trench.

Plate 107.
Partly-filled Trench Silo showing Tractor Consolidating the Material.

Emptying the Trench Silo.

The silage should be removed from one end of the trench, and only that section of the covering material which will allow the required amount of silage to be removed should be disturbed. A sharp hay knife or broad axe is very suitable for the cutting of the silage. It should be removed in vertical sections, thus exposing the minimum amount of silage to the air.

Stack Silage.

Silage may be easily and cheaply conserved in stacks, but this method is only recommended when the silage is to be used within a few months after being made. Even when most carefully built, exposure to the atmosphere causes wastage on the sides and ends of the stack, and this increases with time. The stack should be erected in a well-drained situation, and in a position handy for feeding. A further point to be considered in selecting the site is the proximity of the stack to the field in which the crop to be used is growing. A rectangular-shaped stack is to be preferred to a square stack, one of the main advantages being the reduction in the surface of silage exposed when the end of the stack is opened for feeding.

Framework.

The framework consists of bush timber from 4 inches to 6 inches in diameter at the butt end, erected in the manner shown in Plate 108. The poles are sunk in the ground to a depth of approximately 20 inches, and

should be at least 15 feet above ground. The top plates and the brace at each permanent end of the stack should be fastened to the uprights with a wire twitch. Where a stack of large dimensions is being built, or where a light framework is used, it is advisable to provide one or more cross braces for the framework. When only one cross brace is used, it should be fastened to the central upright on either side, and provision made for the central uprights to be at least 3 feet higher than the others. It is then possible to have the central brace much higher than the top of the framework, and thus offering less obstruction when stacking the material as the stack is nearing completion. Any other cross braces used should be handled in the same manner as the central brace. In addition to the uprights required for the framework, a pair should be erected at each end of the stack to bear the cross piece which is used to support the ends of the fodder until they are trimmed off level with the permanent end of the stack. The uprights along the side should be spaced 3 feet apart when long-stalked crops are being stacked. The distance is reduced to 2 feet 6 inches or, if necessary, to 2 feet for shorter-stalked crops like white panicum or Sudan grass. Where possible, the framework should be erected close to a tree, which can be used to support the whip for lifting the material when the height of the stack calls for its use.

Stacking.

Before commencing the stack, a layer of green grass, at least 6 inches in depth, should be spread evenly over the ground to prevent the silage from coming in contact with the earth.

When stacking maize or sorghum, the farmer should begin by laying the material in such a way that the heads of the plants extend 3 feet to 3 feet 6 inches beyond the permanent end of the stack, the distance being reduced to suit shorter-stalked crops. He should continue to lay the material evenly, with the heads facing the one way, until the butts of the plants extend a similar distance beyond the opposite permanent end. The material should not be laid end to end, but should be laid in such a manner that it overlaps for about one-third of its length. After placing a layer along the entire length of the stack, the next layer should be commenced by laying the material in the reverse manner—*i.e.*, the butts should be facing the direction in which the heads are facing in the previous layer. The work should be continued in this manner to the opposite end of the stack. By reversing the layers in the manner described it is possible to maintain an even surface, particularly when heavy-stalked crops are being stacked. When the material has been stacked to a height of 2 feet 6 inches, the projecting ends of the material being stacked should be trimmed off flush with the uprights which are to form the true end of the stack. A sharp cane knife will be found very suitable for trimming the ends. Before stacking is resumed, the cross piece which is used to support the projecting ends of the material should be raised level with the top of the stacked material and fastened to the additional uprights which have been provided for that purpose. Each time a similar quantity of material has been added to the stack the projecting ends are trimmed as previously described, and the cross piece again raised level with the top of the stack. The trimmings should be laid along the centre of the stack. During the whole time stacking is in progress, the material should be well trampled along the sides.

When the material is carted by dray or lorry, it is not necessary to use a whip or hoist until the stack is nearing completion, as the

Plate 108.
Silage Stack in Course of Building.

material may be handed from the vehicle to the person on the stack. In this case it is very necessary that the material be received from both sides of the stack, for if received from one side only, the extra trampling will cause a much more rapid settling on that side. As a consequence, the material on the opposite side of the stack will not consolidate sufficiently to permit of the production of good silage.

After stacking has been finished at the end of each day, it is a good plan to add weight to the stack. An easy and effective way of doing so is by passing lengths of fencing wire over the stack and suspending a long pole from these on either side of the stack. These poles should be suspended well clear of the ground, as a considerable amount of settling takes place during the night. Very little additional time is required in applying the weight each evening and releasing it the following morning.

When the whole of the material has been placed in the stack, a layer of green grass at least 6 inches in depth should be spread over the top of the stack. Earth, stones, or other weighting material should then be placed on this, forming a camber along the length of the stack. When earth is used, it is advisable to lay light logs along each side and end on the top of the stack to form a bed to keep the earth in position. To provide the required pressure, a layer of earth at least 1 foot in depth is necessary. After placing the weighting material in position, a covering of dry grass should be placed on top of this, and as it is very necessary that water should not gain access to the silage, the earth and grass should be placed in such a way that rain water is turned over either side of the stack. This means that, when completed, the stack will be appreciably higher along the centre than at the sides.

Opening the Stack.

The silage should be removed from one end of the stack only, using a hay knife or broad axe to cut a shelf from top to bottom. Only sufficient of the covering should be removed to permit of each day's requirements being taken out, and as small a surface as possible should be exposed to the air. A certain amount of wastage will inevitably occur on the ends and sides, but, providing the material has been carefully stacked at the right stage of growth, and the silage has not been kept for more than four or five months, the wastage should not be great.

THE COUNTRYMAN'S SESSION

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Community One-variety Cotton-growing.

A. NAGLE, Senior Instructor in Cotton Culture.

THE benefits obtained by a community through growing only one variety of cotton are resulting in the rapid increase in the adoption of this form of cotton production in many cotton-growing countries. In the United States of America, for instance, since 1932 over a thousand organizations have been formed to grow cotton on this basis. In some cases there, the organization may consist of only a small group of farmers formed to grow a variety, but in most instances it is on a much larger basis, such as a county or a group of counties with a membership of hundreds of growers producing thousands of acres of the one variety.

In the United States of America this form of community enterprise provides a means whereby the farmer can produce cotton of high quality, which is ginned efficiently and sold at its full value. It has also been demonstrated that when a group of farmers grows only the one variety known to be suitable for the district, the farmer is more inclined to study his methods of production when low yields are obtained rather than blame the variety and change over to another one. Undoubtedly community one-variety cotton-growing should be adopted wherever soil and climatic conditions are suitable for this method of cotton production.

The available information in Queensland on the suitability of the main soil types for cotton and the best variety or strain to grow on each, allows of a summing up of the possibilities of community one-variety cotton-growing being established in this State.

In the earlier years of the present cotton-growing industry in Queensland there were available for general distribution only a few varieties of cotton, which had been introduced on account of their performances in their country of origin making them appear to have possibilities here. Owing to the rapid expansion of the industry these relatively uniform varieties had to be released to meet the demand for planting seed before their suitability for the various conditions had been fully investigated. Consequently, the one variety was allotted in some instances to all growers in a small isolated district. When such a district embraced a wide range of soil types as, for example, in a valley where cotton was grown both on the slopes originally under brigalow and softwood scrub and on the alluvials originally under eucalypt forests, the yields of cotton obtained frequently gave clear-cut evidence that a variety suitable for the slopes need not necessarily produce good crops on the more fertile alluvials.

Such variations in yields led to the carrying out of a long series of investigations, the results of which indicate that in most cotton-growing

districts of the State at least two varieties will be required—one for the more fertile loams and sandy loam soils, and one for the clay loams and heavy clay soils. Unfortunately, the same two varieties cannot be used in all districts, but it has been possible, however, to select five out of a large number tested, which will meet the needs of the main commercial areas. A description of these varieties with detailed recommendations for their use will appear in later numbers of this Journal.

The Queensland system of a growers' commodity board controlling the whole of the cotton crop and ginning it in large centrally-located ginneries, where upwards of 10,000 bales of raw cotton or 30,000 wool packs of seed-cotton may be ginned annually in the one ginnery, is conducive to obtaining low-operating costs and efficient grading, ginning, and marketing. Under this system the commodity board takes possession of each grower's cotton as soon as it is placed on rail at his nearest railway station, and pools all freight, grading, ginning, and marketing charges incurred for the whole crop. When a grower's cotton arrives at the ginnery in either woolpacks or bags, each container is weighed, graded, and stapled separately by a Government grader, and the grower is paid a first advance of approximately 80 per cent. of the estimated value of his cotton—based on the selling agreement made by the Commodity Board with the Australian spinners. This payment provides for the price differential due to the grower on account of the grade and staple of the fibre and the lint percentage of his cotton. Subsequent payments, as the monies accumulate from the sale of the crop, are made on a flat rate per lb. basis, according to the amount of raw cotton he forwarded. It is not necessary, therefore, to maintain his identity with his cotton after it has been weighed, graded, and stapled. Each container of any consignment is therefore distributed in the large cotton receival house according to its grade, staple, and variety. This procedure allows of the accumulation of a considerable amount of cotton of the one grade, staple, and variety to be ginned in the one "run," thereby eliminating the possibility of serious "plating" of the bales of raw cotton occurring through consignments of cotton of markedly different grade following each other in the ginning operations. This latter feature is further guarded against by running out the breast rolls in the ginnery before changing over to another grade, and also by following on with the nearest similar grade and staple length of the same variety wherever possible.

During the ginning operations, two lint samples are drawn from each bale of raw cotton for grading and stapling by a check grader who grades against the World's Universal Standard for American Upland Cotton. As the grade and staple length of each container of seed-cotton contributing to each bale of raw cotton is known, the efficiency of the seed-cotton grading and ginning operations can be maintained, thus ensuring that each farmer's cotton is processed in a manner that will permit the Commodity Board obtaining the fullest possible value of it.

It is obviously desirable to reduce the number of cotton varieties arriving at a ginnery to the barest possible minimum required to meet the demands of the districts forwarding cotton to it, if the ginning and pure-seed operations are to be maintained on a highly efficient basis. Each season pure seed of each commercial strain is allotted to sufficient growers to produce the estimated planting requirements for each strain in the following season. These growers normally plant on land not under cotton in the previous season, and which is at least a half mile from any other strain. The high-grade cotton produced by such selected

growers is accumulated according to strain, grade, and staple until sufficient is available to warrant the expense of cleaning the ginning plant of all seed prior to ginning the pure seed. As it is necessary to have replacement stocks to maintain or in some cases, improve the standard of the commercial stock of a variety, it can be appreciated that the maintenance of pure-seed stocks of several varieties at a ginnery increases the cost of, as well as complicates, the ginning operations.

It is highly desirable, therefore, if a whole district cannot successfully grow one variety, that groups of farmers grow only that variety known to be suitable for their particular conditions. Such groups will assist the field staff of the Department of Agriculture and Stock in arranging for the production of planting seed, as well as in the carrying out of the advisory and investigational work. The farmers will also have the benefit of each other's experiences, and where a farmer fails to obtain a satisfactory return he may be able by comparing his methods with those of successful neighbours, to improve his yields. Where, however, each neighbour grows a different variety, the comparing of methods is not a sound procedure, owing to the fact that the varieties frequently respond differently to climatic conditions. In some districts the lack of community one-variety growing has handicapped the work of ascertaining the most suitable soils for cotton, the best variety to grow, and the correct cultural methods to use in growing it.

In some districts where each farm includes both fertile alluvial flats and slopes of lesser fertility, it has been noted that some farmers try to grow the one variety on both soil types. This is frequently inadvisable, particularly if there is a marked difference in the fertility of the two types of soils. In such instances the most suitable variety for the fertile alluvial soils is likely to react severely to stress conditions in midsummer if it is planted on the less fertile and generally shallower soils of the slopes. Consequently, in these areas the farmers must plant varieties adapted to their main soil types. It is considered, however, that it would be more advisable for such farmers to decide what are the best crops to grow on each of their soil types. They can then concentrate on determining the most efficient methods for growing cotton on their soil type which appears to be the most logical for this crop. This would allow of one variety growing within each group with similar conditions and would also simplify the cultural problems of a group through the confining of cotton growing to only one general type of soil in their area.

Summary.

Although it does not appear possible to develop cotton growing in Queensland on an extensive community one-variety basis, the system evolved in this State, whereby a grower organization controls the ginning and marketing and the Department of Agriculture and Stock is responsible for the breeding and distribution of planting seed and the grading of the resultant cotton, gives the cotton farmer most of the advantages of recent developments of this kind overseas. In many instances, by having a choice of varieties according to his soil type, the farmer undoubtedly improves the chances of obtaining satisfactory returns. Wherever possible, however, a group of farmers with comparable conditions should grow only the variety suited to their major soil types. By concentrating on learning how to grow to the best advantage the selected variety on their most suitable soil for it, the farmers will get better returns than are realized when varieties are changed yearly or a single variety is grown on every soil type on the farm.

Vegetable Production

Vegetable Growing in North Queensland.

S. E. STEPHENS, Northern Instructor in Fruit Culture.

PART 2.

Fertilizers.

ARTIFICIAL fertilizers are necessary to obtain best results from vegetable crops, but they will give maximum results only when used as a supplement to green manure and stable manure. It must be realized that artificial fertilizers will not take the place of green manure, and, conversely, that green manure will not take the place of fertilizers. Green manure supplies the organic matter that keeps the soil in good heart, but it cannot supply minerals which are deficient in the soil since it is dependent on the soil to supply its minerals in the first place. Where minerals are lacking they must be furnished by the application of artificial fertilizers.

In vegetable farming it is now a generally accepted procedure to fertilize the crop rather than the soil; that is to say, a complete fertilizer mixture containing all the main plant foods necessary to grow the crop is applied, rather than only those ingredients in which the soil is known to be deficient. This considerably simplifies fertilizer practice by limiting the number of fertilizer mixtures needed, and is quite satisfactory in most instances. If the soil is heavily supplied with one or more plant foods in available form, or if it is very deficient in one or more of them, the standard mixture does not then give such satisfactory results as a special mixture put up to meet the special conditions. The mixture that is found to give best results on most of the alluvial country is one with a formula of approximately 4-12-5 or 5-13-5; that is, 4 per cent. nitrogen, 12 per cent. phosphoric acid and 5 per cent. potash, or 5 per cent. nitrogen, 13 per cent. phosphoric acid and 5 per cent. potash. Mixtures with approximately these formulae have been found generally suitable as a basal (i.e., pre-planting) fertilizer for most vegetable crops. Some crops, such as greens, require additional fertilizers in the form of top dressings. The special fertilizers required for various crops will be dealt with later in connection with the individual crops.

The highly acid red soils of the coastal belt and of some of the Atherton Tableland areas which lie east of the Barron River have special requirements. These soils are very deficient in lime, potash, and available phosphate. The neutral or alkaline soils of parts of the Burdekin and Don River areas and the red soils of the Atherton Tableland maize belt are well supplied with phosphate and potash. The acid soils need lime and a fertilizer mixture containing high proportions of phosphate and potash, whilst on the neutral soils no lime is needed and a mixture with lower percentages of phosphate and potash is suitable.

In applying fertilizer, some care must be exercised in placing it in the soil in such a position that the plants will obtain the greatest benefit from it. The basal dressing applied before planting the seed or seedlings should be well mixed with the soil immediately below the rows in which the seed or plants will be set. It should be placed so that it will be about 2 inches below the position the seed or seedling will occupy. Under no circumstances should the fertilizer be so placed that the seed comes into direct contact with it, or "burning" will result. If it is proposed to fertilize after planting, the fertilizer should be banded to a strip 2 inches to 4 inches to the side of the seeds or plants and slightly below their level.

Many soils have a tendency to fix phosphates, making them unavailable to plants. By concentrating the fertilizer in a band the plants are enabled to obtain some of the phosphate before it becomes "fixed."

Rate of application of fertilizers varies according to the intensity of cropping and the class of soil. An average dressing is about 5 cwt. per acre. At this rate of application the quantity of fertilizer to be applied per 100 feet of drill is as follows:—

With drills 21 inches apart 2¼ lb. per 100 feet.
With drills 24 inches apart 2½ lb. per 100 feet.
With drills 27 inches apart 3 lb. per 100 feet.
With drills 30 inches apart 3¼ lb. per 100 feet.
With drills 36 inches apart 3¾ lb. per 100 feet.

Sowing.

This operation is carried out direct to the field with some crops, such as carrots, beet, beans, peas, radish and cucumber, and to seed-beds for subsequent transplanting to the field with other crops, such as all the cabbage family, egg plant, tomato and capsicum. Some crops, such as lettuce, choys (or Chinese cabbage), and indeed any of those usually transplanted, may also be sown direct to the field. Sowing to seed-beds has the advantage of more effective control of the factors affecting germination, hence this method is desirable when field conditions are unfavourable for good results. With suitable field conditions, however, direct sowing to the field will usually result in earlier harvesting by at least a week, owing to the temporary setback received by transplants.

When sowing seed direct to the field a power or hand-operated wheel planter is the most efficient planting machine. When large fields are to be sown the multiple-row, power-operated machine is desirable on account of the saving of labour and seed, the even and regular planting that it permits, and the assistance thereby given to subsequent cultural operations. On smaller areas the hand-operated, single-row wheel planter is quite effective and gives the advantages of the power machine on a smaller scale. There is also an indirect advantage to be obtained from machine planting. Machines will not operate efficiently in land that is not properly prepared for seeding, hence the use of a planter necessitates effective seed-bed preparation. Hand planting should be used only on garden areas. On a commercial scale it is undesirable, because it is not possible to regulate accurately either the rate of sowing or the depth of planting, and the amount of labour involved in this method is large.

Depth of planting varies with the variety of seed and also with the soil and climatic conditions. In the autumn months—March to May—

when there is good soil moisture and the soil temperature is moderate, shallow planting will give good results. Later in the year, during the dry spring months when soil moisture is less and the surface soil temperature is rising, deeper planting is desirable. If irrigation is available, shallow planting may be the general rule at all seasons of the year. The depth of planting recommended for various seeds, when optimum field conditions prevail, is given in Table 1, together with the recommended rate of sowing.

TABLE 1.

Crop.	Seeding.*	Seeds per Oz.	Rate per 100 ft. Drill.	Seeding per Acre.	Depth of Planting (Inches.)	Duration of Crop (Weeks.)	Approximate Yield. (Tons per Acre.)
Bean, French	*a*	100	8 oz.	¾ bus.	¾–1	6–8	2–4
Bean, Long	*a*	200	4 oz.	40 lb.	¾–1	6–12	5
Beet	*a*	1,500	½ oz.	4 lb.	¾–1	10–15	5–8
Broccoli Sprouting	*b*	10,000	60–70 plants	4 oz.	½	12–20	5
Cabbage	*b*	7,500	60–70 plants	4 oz.	½	10–12	10
Carrots	*a*	20,000	½ oz.	2½ lb.	½	10–12	5–8
Celery	*b*	80,000	150–200 plants	2 oz.	½	16	6
Choys	*b*	7,000	80 plants	4 oz.	½	6	10–15
Cucumber	*a*	1,000	½ oz.	2 lb.	1–2	8–9	6
Egg Plant	*b*	6,000	50 plants	4 oz.	½–1	15–20	5
Kohlrabi	*b*	8,000	200 plants	2 lb.	½	10	6
Lettuce	*a* & *b*	20,000	100–120 plants	1 lb.	½	8–10	5–8
Parsnip	*a*	7,000	½ oz.	3 lb.	½–1	20	4
Peas	*a*	100	1 lb.	1 bus.	1–2	10–20	1
Peppers and Capsicums	*b*	4,500	½ oz.	3 oz.	½–1	12–20	5
Radish	*a*	4,000	½ oz.	8 lb.	1	4	5
Shallots	*a*	..	200–300 bulbs	..	2–3	6–10	4
Spinach	*b*	3,000	1 oz.	8 lb.	½	6–8	6
Spinach (Summer)	*b*	100,000	½ oz.	2 oz.	½	5–6	6
Spinach (New Zealand)	*b*	300	1 oz.	4 lb.	1–2	8–10	6
Tomato	*b*	10,000	50 plants	2 oz.	½–1	10–12	3–5
Turnip	*a* & *b*	13,000	½ oz.	1½ lb.	½–1	10–12	6–8

* Sown direct to field. (*b*) Sown to seed-beds for transplanting to field.

Seed-bed Treatment.

When sowing is made to a seed-bed or box for subsequent transplantation it is possible to arrange for optimum conditions for healthy and sturdy growth. In order to minimise risk of soil-borne diseases being carried over from one crop of seedlings to the next, it is desirable to select a fresh area for each set of seed-beds. A site should be selected free from the possibility of contamination by drainage from infected land. Close proximity to a good water supply is also essential. Partial sterilization of the seed-bed soil is recommended wherever possible, and is very desirable in the case of land known to be infested with nematodes or fungi. The simplest and most effective method of sterilization is burning, and this method has the added advantage of destroying weed and grass seeds in the soil, thus ensuring a weed-free stand of seedlings. The firing of the beds is done with wood in sufficient quantity to heat the soil 6 to 8 inches deep to a temperature of 180 deg. to 200 deg. F. This temperature should be reached as rapidly as possible and maintained for ten minutes, and the soil then rapidly cooled. The fire should not be made so fierce that the soil is burnt, as this destroys all life, including nitrifying and other beneficial bacteria.

The treatment of small quantities of soil, such as are required for seed boxes, by the heat method may be carried out by heating the soil in shallow trays placed in an oven, or alternatively by steaming it. The equipment necessary for steaming soil consists of a steamer such as a

40-gallon drum standing on fire-bars. A small quantity of water placed in the bottom of the drum generates steam, which passes through several shallow, perforated trays that hold the soil, arranged above one another and clear of the water. The top of the outer container should be covered first with a bag to absorb moisture from the condensed steam and then with a timber or iron lid. A thermometer placed in the soil of the trays assists in determining whether the sterilization process is being satisfactorily carried out. In this method of sterilization hot, live steam is essential to success, otherwise the steam condenses too readily and saturates the soil with moisture without raising it to the required temperature.

Soil disinfection against various fungous organisms may be carried out by the use of formalin solutions. The recommended application for a moist soil is a 2 per cent. solution of commercial formalin (1 gallon of formalin in 50 gallons of water) watered on at the rate of 5 gallons or more per square yard. A 1 per cent. solution of formalin applied at the rate of 10 gallons per square yard is used on dry soil. A covering of sacks is allowed to remain on the beds for two or three days and the beds are then aired for about ten days before sowing the seed.

Plate 109.

A Properly Treated Seed-bed showing Weed-free Growth and Regular Stand of Seedlings.

Seed boxes are only suitable for the raising of small numbers of plants, hence are more useful for the home gardener and small market gardener than for the large-scale grower. The boxes have an advantage, however, in that they can be insulated from earth contact to prevent invasion by seed harvesting ants, which in some seasons cause considerable loss in small-seeded types of vegetables. The boxes also have the advantage, for the raising of early seedlings during the tropical wet season, of being easily moved into cover during rain and into the open during fine periods. The boxes should be deep enough to hold about four inches of soil, and the soil used in them should be a carefully prepared potting loam of open texture, good moisture-holding capacity, and reasonably well supplied with plant foods.

Seed-beds, after sterilization, should be carefully dug over and reduced to fine tilth to fork depth. If the soil is not naturally sufficiently rich a light dressing of complete fertilizer mixture at the rate of 1 oz. per square yard may be broadcast and thoroughly mixed with the soil. If fertilizer is used in seed-bed preparation it is desirable to permit several days to lapse between its application and the planting of the seed in order to allow it to dissolve and permeate the soil. A final digging over and raking down should be given to the bed immediately before planting. Very rich soil is neither necessary nor desirable for seed-beds. Such soil promotes rank growth of succulent nature, giving soft plants which do not transplant readily and which are susceptible to damage and attack by insects or diseases.

In both seed-box and seed-bed planting it is usually considered desirable to plant the seed thinly in rows spaced 3 inches or more apart. The reason for this is to allow free circulation of air between the plants and to give all plants reasonable space for development. Row planting helps to produce stocky plants with good root development, whereas broadcast planting, unless done very thinly, tends to promote spindly growth and disease development.

Seed Treatment.

Many diseases of vegetables are seed-borne. Some, such as damping off, show up whilst the plants are still in the seedling stage, whilst others usually become evident only in more advanced stages of growth. Several methods of seed treatment have been evolved to prevent the development of these diseases, and even though all samples of seed do not carry disease spores it is still a wise policy to make a practice of treating all seed before planting. Several proprietary mixtures are available for the control of different diseases and in addition certain chemical compounds may be used. A further method of treatment that is effective against a number of diseases is the hot water treatment.

Details of seed treatments may be obtained on application to the Plant Pathology Section of the Department of Agriculture and Stock.

Rotational Cropping.

Some regular system of cropping on each part of the farm or plot of land is desirable for many reasons, such as regular replenishment of soil organic matter, balanced removal of plant nutrients from the soil, and checking of insect pests and diseases.

Owing to the rapid maturing of most vegetable crops under the tropical conditions of North Queensland, it is usually possible to grow several crops on the same piece of land in one year. Such intensive cropping makes a heavy drain on the soil, however, and unless the cropping is intelligently planned will quickly ruin the land. The very intensiveness of vegetable-growing, whilst making a definite rotational cropping plan difficult, renders such rotation all the more necessary. It is therefore desirable to spend some time in drawing up a cropping plan to cover each field or plot for several years according to the length

Plate 110.

The Annual Green Manure Crop round which the Rotation should be Built.—A heavy cover of cowpea for ploughing under.

of rotation decided upon. With quick-maturing crops the factor having the greatest bearing on length of rotation is the control of pests and diseases. Certain crops are hosts for specific diseases, hence they should not occupy the same piece of ground more than once during the period that the particular disease will live in the soil. Three or four years has usually been found to be the minimum safe period for the control of these soil-borne diseases. Certain varieties of vegetables that are resistant to their specific diseases have been developed, however, and the use of these resistant varieties allows the adoption of a shorter rotation.

The annual green manure crop during the wet-season period should be the base upon which to build the rotation. This should be followed in succession by crops that will, as far as possible, balance one another in their draw on the plant foods in the soil. For instance, a crop that draws heavily on the nitrogen content of the soil should be followed by one that requires a greater proportion of potash or phosphate; one that draws most of its requirements from the surface soil should be followed by a crop with a deep-feeding root system; a crop that is tolerant to acid conditions should follow one that draws on the lime content.

Table 2, which shows the degree of acidity-tolerance, the type of root system, and the climatic requirements of various crops, will assist in working out appropriate rotation tables. The crops marked "cold" should be grown only on the highlands during the winter months. Coastal temperatures, even in the winter, are rarely low enough to enable good commercial crops of these vegetables to be produced, although occasionally the home gardener will be able to produce small quantities under special conditions. Plants marked "moderate" will usually withstand light frosts and thrive under temperatures up to about 80 degrees F. Those marked "hot" require that the temperature should be always above about 60 degrees F., whilst those marked "tropical" thrive best when the temperature is consistently high.

TABLE 2.

Intolerant to Acid Soil. (Optimum pH* over 6·0.)			Moderately Tolerant. (Optimum pH over 5·5.)			Very Tolerant. (Optimum pH over 5·0.)		
Asparagus	(D)	C	Cabbage	(S)	C–M	Beans	(S)	H
Beetroot	(S)	M	Carrot	(D)	M	Brussels Sprouts	(S)	C
Broccoli, Green Sprouting	(S)	M	Choys	(S)	M	Egg Fruit	(D)	H–T
Cauliflower	(S)	C	Cucumber	(D)	H–T	Endive	(S)	M
Celery	(S)	C	Pepper	(D)	H–T	Kohlrabi	(S)	M
Lettuce	(S)	M	Silver Beet	(S)	M	Parsley	S)	M
New Zealand Spinach	(S)	H				Pea	(D)	C
Okra	(D)	H–T				Radish	(S)	M
Parsnip	(D)	M				Rhubarb	(D)	C
Spinach	(S)	C				Squash		H
						Swede Turnip	(D)	M
						Sweet Corn	(D)	H
						Tomato	(S)	H

Key: S = Shallow rooting. D = Deep rooting.
C = Cold. M = Moderate. T = Tropical.
H = Hot.

* pH is the soil chemist's method of expressing soil acidity. A neutral soil has pH of 7, a very acid soil a pH of 4–5.

By using this table and referring back to Table 1, which gives the average duration of the various crops, a planting schedule for either

coastal or highland areas may be drawn up. For instance, the following are two rotations of three-year duration that would be suitable in some coastal areas:—

ROTATION 1.

1st year. Green manure (legume).	2nd year. Green manure (legume).	3rd year. Green manure (legume).
Carrots	Cucumber	Lettuce
Beans	Choys	Swede turnip
Peppers	Tomatoes	Gramma pumpkin
	Long beans	

ROTATION 2.

1st year. Green manure (legume).	2nd year. Green manure (legume).	3rd year. Green manure (legume).
Cucumber	Choys	Lettuce
Beetroot	Tomatoes	Cabbage
Beans	Sweet corn	Squash
Egg fruit		

Each farmer should draw up rotation schedules to suit his own conditions of soil and climate; and consideration should also be given to the requirements of his market, since it is useless including a crop for which there will be no demand. The farm should be mapped out, a schedule drawn up for each field or plot, and that schedule strictly adhered to.

Irrigation.

As has been already pointed out, irrigation is a requisite of successful vegetable farming or market gardening in all parts of North Queensland. In no part of the northern area is the rainfall spread sufficiently evenly over the whole year to enable successful growing without irrigation. Successful irrigation practice requires careful observation on the part of the farmer. No general directions can be given as to either quantity of water to be applied or frequency of the applications. These matters depend on local conditions of soil, location, climate, and season, as well as the type of crop, all of which are variable factors. By close observation the farmer may find that different parts of his farm require different amounts of water, and that the frequency requirement also varies. The only way in which he can ascertain his irrigation requirements is by trial. Water must be applied until all the soil to the full depth of the roots of the crop has been thoroughly wetted. Water in less amount than this is of doubtful value—it is, in fact, of the same value as the light shower known to the farmer as "grass rain"—for only the surface roots of the crops are able to absorb it. Such watering, if repeated, will influence the plants towards surface rooting, when they will suffer the risk of drying out and wilting. Over-watering is just as serious as under-watering, since it is a costly waste of time, labour, and fuel, and carries much of the soluble fertilizer with the water to the lower depths of the soil where it is out of reach of the plants. The farmer should therefore make actual tests of his soil during watering, with a shovel or soil auger, to ascertain the depth to which the water has penetrated. The tests should be made wherever the soil varies, as the change in texture of the soil will probably mean a variation in the rate of water penetration. A penetration chart based on these trials can be drawn for the farm. On future occasions it will then only be necessary to refer to the chart to ascertain the length of time a particular field must be watered to give a penetration to the desired depth.

The simplest and cheapest form of irrigation is the gravity-fed furrow system, but it is only rarely that land is so situated that the farmer has the advantage of such a supply. Where a stream or spring is available from which water can be gravitated to the vegetable land full use should be made of it. In such an event the water may be led in an open drain if the soil is not of too open texture, or alternatively may be conveyed in pipes to the field.

Failing a gravitational supply, plant must be installed for pumping the water. This may take the form of a windmill and tank, or even a hand pump, for a small home garden; but a power-driven centrifugal pump is necessary for the irrigation of any larger area. The centrifugal type of pump is designed to give a high rate of delivery of water where the lift is small and the discharge line short. These pumps are made in one, two, and three stages to meet various requirements, the higher stages being more effective under difficult operating conditions than the single stage. Various sizes are made, such as 2 inch, 3 inch, 4 inch, &c., the sizes referring to the diameter of the pump discharge outlet. The size governs the maximum output of the pump in gallons of water per minute, and is one of the main determining factors in the selection of a unit. Before installing a pump, the farmer must first assure himself of the quantity of water at his disposal. A flowing stream or a lake is generally the most satisfactory source of supply. In the Burdekin and Don deltas and some of the dry watercourses of the Charters Towers district, large streams of water running underground in gravel beds provide adequate reservoirs on which to draw for the operation of centrifugal pumps. Generally speaking, wells and small lagoons are quite unsuitable for this type of installation.

The size of pump selected should be sufficiently large to enable the delivery of at least an inch of water per acre per week over the whole area to be irrigated. As an inch of water over an acre equals 22,000 gallons, this means that the weekly capacity of the pump must be 22,000 multiplied by the number of acres. In a 10-acre farm, for example, this amounts to 220,000 gallons per week. A good 3-inch pump working at maximum efficiency would deliver this quantity in twenty-two to twenty-five hours, whilst a 4-inch pump, working under the same conditions, would require fourteen to sixteen hours. If a small stream is to be drawn upon, the farmer would be wise to obtain an estimate of its flow during the dry period of the year, and regulate the size of his pump and consequently the size of his irrigated area accordingly, taking into consideration the riparian rights of his neighbours lower down the stream.

Power for the operation of an irrigation pump may be provided by an electric motor, a stationary engine or a farm tractor, and the pump may be direct coupled or belt driven. A very useful type of installation where the farm has a long frontage to the water supply and pumping points can be located at intervals along the frontage is one in which the pump and motor are mounted on a carriage that can be towed from place to place. Whatever arrangement is adopted, and whatever the motive power used, there should be an ample reserve of power above that required for the efficient operation of the pump. This is desirable to curtail wear and tear, which increases rapidly as the maximum load of the motor is approached. Table 3 indicates the approximate horse-power required to pump water against various total heads from 20 feet to 100 feet. Total head is the pressure against which

the water is to be pumped and is usually expressed in feet. It consists of the sum of (*a*) the vertical height of the highest part of the delivery line above the intake water level, called the "Static head," (*b*) the pressure necessary to overcome the friction in the pipes, and (*c*) the pressure required to operate sprinklers if they are used.

TABLE 3.

Discharge. Gallons per Minute.	Horsepower Required to Pump against Total Heads of								
	20′.	30′.	40′.	50′.	60′.	70′.	80′.	90′.	100′.
50	0·5	0·76	1·01	1·26	1·52	1·77	2·02	2·27	2·53
100	1·01	1·52	2·02	2·53	3·03	3·54	4·04	4·55	5·05
200	2·02	3·03	4·04	5·05	6·06	7·07	8·08	9·09	10·10
300	3·03	4·55	6·06	7·58	9·09	10·61	12·12	13·64	15·15
400	4·04	6·06	8·08	10·10	12·12	14·14	16·16	18·18	20·20

Two methods of irrigation are open to the vegetable grower, namely furrow irrigation and sprinkling. The lie of the land and the type of soil very largely decide whether furrow irrigation can be employed successfully. For this method the land must be flat and have an even and unbroken surface, so that furrows may be open beside the vegetable rows to carry the water. Bumps and hollows must be carefully graded out so that the furrows contain neither high spots nor depressions, both of which impede the regular flow of water and interfere with the even watering of the field. If the field has a slope, rows must be planted and the furrows struck on the contour to obtain the slow running of the water necessary to prevent erosion and to ensure proper saturation. Furrows up to 200 yards long may be satisfactorily irrigated by this method. The best length for the furrows depends largely on the texture of the soil. On heavy soils the water should be spread over a greater length of furrow than on loams and allowed to run for a correspondingly longer period, since the heavy soil absorbs water more slowly than the loam. Very porous and sandy soils cannot be satisfactorily watered by this method owing to the immediate penetration of most of the water to the lower soil levels, thus preventing run in the furrows.

Sprinkler irrigation operates efficiently whether the land is flat or broken, and whether the soil is light or heavy. It is, however, much more costly to instal. Plants using light, portable pipes with quick-coupling joints for both main and sprinkler lines are most suitable for vegetable crops. The portable line can be readily moved out of the way for cultivating operations, and when in use it can be readily moved from one field to another so that a large area may be watered with a relatively small amount of pipe.

The use of pipes and spray lines introduces factors of friction head and pressure head into the discussion of a suitable engine and pump. These two items, added to the static head, give the total head against which the engine and pump will be required to work. For any particular size of pipe, friction head increases with an increase in the quantity of water pumped, but when the quantity of water is constant the friction head decreases rapidly with an increase in the size of the pipe. Table 4 shows the number of feet for each 100 feet of galvanised irrigation pipe that must be added in the total head.

TABLE 4.

Discharge. Gallons per Minute.	Friction Head per 100 ft. Pipe, internal Diameter.				
	3″.	4″.	5″.	6″.	8″.
	Feet.	Feet.	Feet.	Feet.	Feet.
25	·2	·05	..	..	..
50	·74	·18	·06	..	..
75	1·6	·39	·13	..	..
100	2·76	·68	·22	·09	..
150	5·96	1·46	·49	·20	..
200	10·31	2·53	·84	·35	·08
300	..	5·46	1·82	·74	·18
400	..	9·42	3·15	1·29	0·31

Pressure head to be added in the total head is calculated by multiplying the pressure in pounds per square inch at which the sprinklers operate by 2·3; thus sprinklers operating at 20 lb. per square inch add $20 \times 2{\cdot}3 = 46$ feet to the total head.

Cultivation.

The chief function of cultivation is the destruction of weeds. Since weed growth competes with the vegetable plants for both moisture and plant food, its eradication in the earliest stages of growth is most desirable. In the young seedling stage the weeds have not had time to develop the extensive root system that not only competes with the vegetables but also makes them difficult to destroy. Cultivation at this period attains the best results with minimum labour and with only shallow working of the soil. This last point is an important one for two reasons—it ensures the minimum disturbance of roots of the shallow-rooted vegetables, and it also prevents the bringing to the surface for early growth of weed seed too deeply buried to germinate. Strictly speaking, each cultivation should be slightly more shallow than the preceding one to make sure of this dual advantage. As well as cultivating for weed control the soil should be stirred as soon after irrigation or rain as it is in a fit condition for working. This is necessary to restore the surface tilth.

Cultivating implements are available to suit all types of crops and all areas from the home garden to the large farm. In the home garden chipping and dutch hoes and the weed eradicator will deal with the tillage. In small market gardens hand-wheel hoes with various attachments for close cultivation and horse-drawn implements for inter-row work are suitable. Small garden tractors for the larger market gardens and field tractors for the vegetable farms are desirable. Both these power implements are fitted with tool bars to take various types of cultivating tools for the tillage of several rows simultaneously. They have been developed in America to meet the requirements of the large vegetable-growing industry of that country. The garden tractor equipment has been tried out in northern vegetable areas with considerable success, and both this and the field tractor machinery have operated satisfactorily in southern States. The great value of these machines on commercial areas is that they reduce hand work to the absolute minimum owing to the exactness with which they may be set to cultivate right up to the rows. Indeed, certain attachments are also manufactured for the mechanical thinning and weeding of the rows. In order that the greatest benefit may be obtained from the machines it is necessary that the land be properly prepared before planting the crop, and where very fine work is required the land should also be free of stones.

PLANT PROTECTION

Fruit Fly Control.

A. W. S. MAY, Assistant Research Officer, and N. E. H. CALDWELL, Assistant Research Officer.

MANY cultivated fruits are subject to attack by flies whose maggots feed within the fruit. Externally, the presence of the maggots is indicated by skin discolouration or premature ripening. Internally, their activities in eating and tunnelling through the tissues (Plate 111; fig. 1) usually set up rots which frequently result in premature fruit fall and always make the fruit unfit for marketing.

Deciduous and citrus fruits are very susceptible to attack, chiefly by the Queensland fruit fly*. Serious losses due to this species also occur in grape, mango, passion fruit, and papaw crops. Tomatoes and cucurbitaceous crops, such as cucumbers and melons, are sometimes attacked by one or more species of fruit fly, the most important being the cucumber fly†, which is also frequently associated with damage to papaws. In the far north, bananas are sometimes severely attacked by the banana fruit fly‡, which may "sting" the fruit while it is still immature. This fly does not occur in other parts of the State but other species occasionally infest bananas if harvesting is delayed and the fruit ripens in the plantation.

Life History and Habits.

Fruit flies are mostly reddish-brown insects with conspicuous yellow markings on the body, and wings which are more or less clear, except for one dark band along the front margin and another towards the base of the wing. Adults may be found under the leaves or, if conditions are favourable for egglaying, on the surface of the fruits. The life history of the Queensland fruit fly is typical of all pest species. The cream-coloured, slightly-curved eggs (Plate 112; fig. 2) are laid in punctures made by the female fly in the skin of selected fruits. Each puncture may contain as many as seven eggs. During warm weather, the eggs hatch in two or three days and the creamy-white maggots (Plate 112; fig. 3) feed inside the fruit and attain their full size of about one-third of an inch within a week. Upon attaining maturity, the maggots leave the fruit which, by that time, has usually dropped from the tree, and enter the soil where each forms a hard brownish pupal case (Plate 112; fig. 4). In the pupal stage, the maggot undergoes a complete transformation into the adult fly (Plate 112; fig. 1) which escapes from the pupal case and forces its way to the surface of the soil. In summer, only two or three weeks elapse from the time the eggs are laid until the adult fly emerges from the soil; in cooler weather, however, this period may be considerably longer. The pest is usually inactive during the winter, though frequently present in citrus orchards in the adult stage.

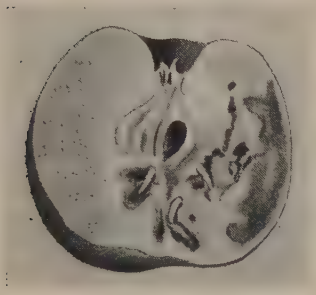
* *Strumeta tryoni* Frogg.

† *Austrodacus cucumis* French.

‡ *Strumeta musae* Tryon.

Control Measures.

The control measures discussed below apply mainly to deciduous and citrus fruits but may, with appropriate modifications, be suitable for other crops. They include luring, bait spray application, orchard hygiene, and the treatment of breeding grounds outside the orchard.



1

2

Plate 111.
Fruit Fly Attack.
Fig. 1.—Fruit fly infested apple. Fig. 2.—Fruit fly sting on passion fruit.
Both figures half natural size.
[*Drawings by J. W. Helmsing.*

Luring.—Luring is the most satisfactory means of reducing fruit fly populations and the following lures, materials for which can be readily obtained, are recommended:—

Lure 1. Formula.—Rind and rag of one ripe or ripening orange, about 2½ inches in diameter; concentrated aqueous ammonia, 18 per cent., 6 teaspoonfuls; tank water, quarter pint.

The orange rind is shredded with a sharp knife. The ammonia and the water are added and the mixture is kept in a tightly stoppered bottle for at least 24 hours before using; this stock mixture can be stored under these conditions for periods up to one month. To make the lure ready for the traps, two tablespoonfuls, i.e., eight teaspoonfuls, of the liquid are added to 3½ pints of tank water.

This lure catches practically no insects other than fruit flies and fouling of the traps is therefore negligible.

Lure 2. Formula.—Maize meal or pollard, 5 level teaspoonfuls; ammonium carbonate (pure), 1 level teaspoonful, or 18 per cent. aqueous ammonia, 6 teaspoonfuls; tank water, 3½ pints.

This lure is ready for use when mixed and catches a number of insects other than fruit flies. Fouling of the traps is greater in the formula containing pollard than is that containing maize meal.

Lure 3. Formula.—Pollard, 2 level teaspoonfuls; cloudy ammonia, 1 teaspoonful; tank water, 1 pint.

This lure can be placed in the traps as soon as it is prepared. It catches fruit flies in large numbers, being apparently more efficient in spring than in autumn, at least in citrus districts. Unfortunately, it catches large numbers of

blow flies which tend to foul the traps after a few days and reduce their attraction to fruit flies. This lure is inferior to lures 1 and 2.

The lure is placed in the common glass fly traps which are then hung in good trapping trees. Most growers are familiar with such trees; they are usually large, leafy and well sheltered. The fly population tends to congregate in parts of the orchard where the fruit is maturing, and trapping trees within, and near to, the block needing protection should therefore be selected at any particular time.

1

2

3

4

Plate 112.

QUEENSLAND FRUIT FLY.

Fig. 1.—Adult × 7. Fig. 2.—Egg × 16. Fig. 3.—Larva × 7.
Fig. 4.—Pupal case × 7.

[*Drawings by William Manley.*

The traps should be hung within the tree away from the direct rays of the sun. Where possible, the bottom of the trap is placed just above a few leaves which serve as a landing platform for the flies. Some growers make use of a wooden platform for the traps which are then supported on short legs so that a space of approximately one inch is allowed between the platform and the bottom of the trap.

As many as six traps can be used to advantage in large trees when intensive trapping is undertaken. Such intensive trapping, i.e. distribution of the available traps in a limited number of selected trees, yields excellent catches and also simplifies re-charging and inspection. There

is no limit to the number of traps that can be used in an orchard but at least ten to each acre of trees likely to require protection at any one time, should meet normal requirements.

Each trap requires about 6 fluid oz. of lure, and is filled at intervals of six days, or more frequently if hot weather causes rapid evaporation of the liquid. Before recharging, the traps should be emptied and then washed in water to remove any sediment adhering to the glass.

Luring should commence in deciduous orchards in early October, when single "pilot" traps are placed in each of six to twelve selected trapping trees throughout the orchard. At the same time, the remainder of the available traps are cleaned and made ready for immediate use when required. Daily inspection of these "pilot" traps, which are, of course, recharged every six days, gives a constant check on fly activity. As soon as an obvious increase in the catch is detected, all available traps should be charged and hung in the orchard, their distribution being so arranged that trees where the flies appear most plentiful are equipped with the majority of the traps. Full-scale luring may be necessary six weeks before the earliest fruit in the orchard matures, and once begun, should be continued until the crops are all harvested. Any cessation of trapping may permit a gradual increase in the pest population to relatively high levels at a time when ripe fruit is on the trees and lures tend to lose some of their effectiveness.

In citrus orchards, the same procedure is adopted even though the fruit does not become susceptible to fruit fly injury until about three weeks before it reaches maturity. However, flies are usually present in the orchard when very immature fruit is on the trees, and it is therefore necessary to place the "pilot" traps in position at least six weeks before harvesting is scheduled to begin in the earliest maturing varieties. Only in this way can a sudden influx of flies be detected, and prompt counter measures carried out. Full-scale luring may be needed in grape fruit, navels, Emperor mandarin, and other early varieties between late February and the end of April in the more important citrus-producing areas. Though the trees may be carrying mature fruit during May, June, and July, the flies are less active owing to the relatively cool weather at that time of the year. It may then be possible to dispense with control measures. Nevertheless, it is advisable to keep the "pilot" traps charged in case a short spell of warm weather induces activity among adult flies overwintering in the orchard, and full-scale luring has to be resumed. In any case, intensive trapping may again be necessary in early August when the fruit of a late-maturing variety such as Valencia is still on the trees and the "pilot" traps indicate the necessity for it.

No definite dates can be given for the commencement or cessation of trapping operations in the various fruit-growing districts. However, information yielded by "pilot" traps concerning the fly population, coupled with the growers own knowledge of the maturing periods of the fruit, makes decisions on these points relatively simple.

Bait Spray Application.—Fruit flies feed readily on sweet solutions and if such solutions containing a suitable poison are sprayed on to the foliage of the trees, considerable numbers of the pest may be killed in the orchard. Bait sprays of this kind are a supplement to, rather than a substitute for, lures and, where possible, the two measures should

be used in conjunction. The sprays appear to give better results in the drier, inland districts where rain does not interfere too frequently with the application of the spray, and where, possibly, other factors make the bait more attractive to the flies than in the wetter coastal districts.

The bait spray should be applied at six-day intervals on trees needing protection when lures indicate that the pest is active. Treatment should be repeated if rain falls and washes the bait from the tree. Applications are best made with some form of spray pump, though, in the absence of such equipment, it may be splashed onto the foliage with a brush. The spray should be applied to the shady side of well-foliaged trees, preferably early in the morning, and care is needed to avoid unnecessarily coating the fruit with spray. Four gallons of the bait spray will provide a single treatment for approximately 150 trees.

Bait sprays may contain lead arsenate, sodium fluosilicate, or tartar emetic as the poisonous ingredient. A convenient formula, containing the first-named poison, which should give reasonable results is:—Lead arsenate, 2½ oz.; sugar, 2 lb.; water, 4 gallons. The efficiency of this formula is apparently improved by replacing the water with an equivalent quantity of fruit syrup prepared by boiling 20 lb. waste fruit in water. Proprietary bait sprays, which merely require the addition of water before use, are marketed in Queensland.

Orchard Hygiene.—Fruit flies should be prevented from breeding in the orchard. If infested fruit is allowed to lie on the ground, the maggots pupate in the soil and eventually give rise to fly populations so large that any control measures are unable to deal with them before a considerable amount of damage has been done. Accordingly, all waste and fly-infested fruit should be gathered at least every three days and treated in such a way that the maggots cannot survive. Methods of disposal include burying, boiling, burning, or immersion in water. The best method of treating large quantities of infested and waste fruit is by means of a pit which should be 6 feet by 5 feet in cross section, 20 feet deep and fitted with a suitable fly-proof cover. Pits of smaller dimensions can be employed if preferred. If the fruit is buried, care should be taken to ensure that it is covered promptly at the end of every six days with at least 18 inches of soil; a lighter covering will not prevent the emergence of flies. Burning also requires attention at least every six days in orchards where this operation is practised, and must be carried out on the actual spot where the fruit is or has been dumped in order to destroy any pupae in the underlying soil. Boiling is effective when it is done as soon as the waste fruit is collected, but if this is not practicable, the fruit should be placed in drums and covered with water pending boiling operations.

Treatment of Breeding Sources Outside the Orchard.—Fruit flies can breed in a very wide range of fruits, and all likely breeding grounds in the vicinity of commercial fruit trees should be ascertained and closely watched. If they are of no commercial value they should be systematically destroyed. If such a course is not practicable, trapping at these centres will often prove very helpful in protecting nearby orchards. If possible, infested fruit in such situations should be destroyed.

Points to Remember.

(1) Luring, bait-spray application, orchard hygiene, and the treatment of breeding grounds outside the orchard are all essential features

in the fruit-fly control programme. The results achieved depend entirely on the efficient application of the recommended measures at the correct times.

(2) Six weeks before the earliest variety is due to mature, "pilot" traps are placed in position and kept charged throughout the season.

(3) When "pilot" traps indicate a rise in the fly population, full scale trapping and bait spray applications are begun immediately.

(4) Waste fruit must be picked up at least every third day.

(5) On every sixth day the lure traps should be washed and recharged, the bait spray should be applied, and waste fruit should be boiled, burned, or buried under 18 inches of soil if it is not emptied into pits fitted with insect-proof covers.

REMOVAL OF SOOTY MOULD FROM CITRUS FRUITS.

Where growers have not been able to deal satisfactorily with scale insects, the sooty mould which accompanies scale infestation will cause some inconvenience. The fungus, as most orchardists are aware, subsists on the sweet secretions of certain scale insects, notably pink and white wax. Except in very severe cases it causes little direct injury to the tree, but the disfiguration of the fruit is a serious matter.

Various methods are used for the removal of sooty mould. In all of them, injury to the rind should be avoided, because it opens the way to infection with blue or green mould in the fruit. With moderate blemishes, a light brushing of the fruit will suffice. If the fruit is badly affected, brushing sufficient to remove the mould may seriously injure the rind. Cleaning the fruit in a rotating barrel partially filled with sawdust is a method commonly used but has little to recommend it. Damaged rind and bruised flesh too often result from this procedure.

If washing has to be resorted to, the fruit should be immersed for about one minute in a solution containing ¼ lb. of boracic acid and ¼ lb. chloride of lime to each gallon of water. This solution has been used extensively by growers and has been found very satisfactory. After immersion in the cleansing solution, the fruit should be well washed in clean water to avoid a whitish deposit on drying, and then should be dried thoroughly before packing.

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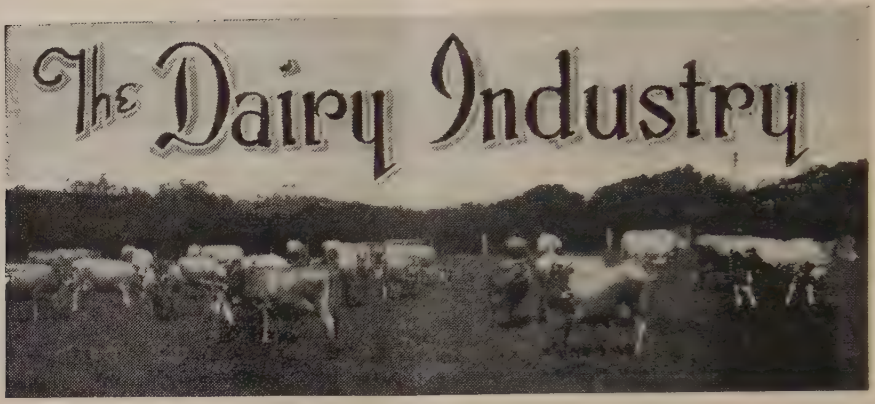


Rearing Calves on Milk Substitutes.

C. R. TUMMON.

AT the present time, some large dairy districts in Queensland are given over almost entirely to the production of milk for direct consumption, and this has given rise to a position in which, in order to rear calves successfully, some substitute for milk must be used.

With milk at the present high price, the incentive is to sell all milk and not bother about rearing calves. By adding the cost of feeding calves on substitute foods, the cost may seem prohibitive, but it should be realised that the cost would be greater if milk were fed alone at its present high price of 1s. 3d. per gallon, approximately. The farmer who rears calves from his best cows has, too, the satisfaction of knowing the type of animal he is producing for his future herd. Again, it should be remembered that almost every farmer in some districts is producing milk and not rearing any calves, so that there is likely to be an acute shortage of young stock in a year or two.

In feeding on substitute foods, three important factors should be borne in mind:—

1. Nutritive ratio;
2. Palatability and digestibility;
3. Cost.

1. *Nutritive Ratio.*—The ratio of digestible proteins to digestible carbohydrates for young calves should be 1 : 3-4.

2. *Palatability and Digestibility.*—Unless the food substituted for milk is both palatable and easily digestible, difficulty will be experienced in getting the calves to drink, and stomach upsets may occur.

3. *Cost.*—Where, for instance, pollard may be cheaper in some areas than other concentrate foods, it would be more economical to feed pollard, and vice versa if other concentrates are cheaper.

Amount to be Fed.

The amount of substitute food given to a calf will vary according to its age and size, and also on the type and amount of green food available. For example, when the calf is very young, the percentage of whole milk is greater than when it becomes old enough to eat grass. Then again, if the available grass is good (for instance, young kikuyu), and there is plenty of it, less concentrates are required.

The following procedure for rearing calves from birth to weaning age at six months, using pollard and meatmeal as a milk substitute, is working out satisfactorily on an Atherton Tableland farm. Of course, other concentrates may be used similarly to pollard and meatmeal, varying the amounts used, according to the nutritive ratio. It has been found that if pollard is started too soon, white scours will result, whereas by first introducing a little meatmeal and gradually building up the amount of pollard this trouble does not arise.

For the first week, the calf is fed on its mother's milk. As this milk, or "colostrum" as it is called, is unsuitable for use for human consumption, there is no economic loss in this first week's feeding to the calf. However, the calf benefits enormously by this, and stomach troubles are avoided. This milk is abnormally high in albumen content, and is intended by nature for the calf to give it a good start in life. The amount of this milk given depends on the size of the calf. A calf weighing about 60 lb. at birth requires 6-7 lb. milk daily for the first week, and this is best divided into several feeds during the day, rather than given at only two feeds. The milk must be fed at blood heat (100 degrees F.).

In the second week, fresh milk is partly replaced by substitutes. The change-over should be gradual, although as quick as practicable, as the cost of feeding on milk is prohibitive. For instance, in the second week, the calf gets 6 lb. fresh milk, 2 lb. water and a little meatmeal (tablespoonful); in the third week it gets 4 lb. fresh milk, 5 lb. water, 2 oz. meatmeal and $\frac{1}{4}$ lb. pollard, as well as having access to clean water and succulent grass. The milk is again decreased by 1 lb. the following week and the pollard, meatmeal and water increased. At the end of one month, the calf gets only 3 lb. milk, but the supplements are built up to $\frac{1}{2}$ to $\frac{3}{4}$ lb. of pollard and 4 oz. meatmeal. The pollard and meatmeal are further increased for the second month, the mixture being built up to $1\frac{1}{2}$ lb. pollard and $\frac{1}{2}$ lb. meatmeal daily. At two months the milk is eliminated from the feed. A change of run is then advisable so that fresh, unscoured pastures are available.

If any hay or silage is available, a little may be fed with advantage. As the calf becomes accustomed to eating more grass, the amount of pollard can be again reduced by $\frac{1}{4}$ lb. daily, the meatmeal being kept at 6 to 8 oz. This amount of meatmeal is provided up to the age of 6 months, when the calf should be weaned.

In mineral deficient country, suitable licks should be available. Salt should also be given when necessary.

Maizemeal can be used with equally as much success as pollard, but it must first be soaked in boiling water.

By providing well grassed and shady calf paddocks, dry pens well-ventilated but free from draughts, periodically liming the places where the calves congregate to reduce the risk of worm infestation, and by properly sterilising calf buckets to avoid scours, it will be found that calves may be reared on substitute foods quite satisfactorily.

The Cleansing of Dairy Utensils.

F. C. COLEMAN, Dairy Branch.

DAIRY bacteriologists, factory managers and all personnel associated with the management and control of dairy products, agree that the efficient cleansing of utensils on the dairy farm is among the most important jobs which the dairy farmer has to undertake, and has a pronounced influence on the quality of milk and its products.

Good results will definitely be obtained if cleansing is properly and regularly done, results which will bring benefit and satisfaction to the dairy farmer and factory manager alike. Some time ago, a certain factory adopted the practice of issuing an attractive certificate to each supplier who sent in 100 per cent. choice cream during the year. The dairy farmers concerned took a great pride in the possession of these certificates and were pleased to discuss the matter with any interested person, and to explain how they were able to achieve such results. By this they were encouraged to maintain throughout the year the high standard reached, and would be disappointed if that record were broken by even a single first grade.

The "Model" Dairy and a Contrast.

A visit to these farms all told the same story—an obvious and noticeable neatness and cleanliness of premises, yards and more particularly, utensils. Invariably they were men who relied on something more effective than a kerosene tin of "boiling" water, men who cleansed their equipment regularly, not once a day, but *twice*.

A glance at the separator parts, buckets, strainers and vats hanging up or spread over a bench, will usually indicate whether the owner is likely to get choice grade, first or second grade for his product. Utensils which are bright in appearance and perfectly dry, indicate that they have been properly cleansed and scalded in *boiling* water. Moreover, they smell sweet and clean and will not impart any undesirable odours or taints to the milk or cream for which they are used. In addition, the effect of being left to dry by the extreme heat generated by the boiling water prevents rust.

Take a look at another dairy. Here the separator discs are greasy on top, but more so underneath and covered with droplets of water. The rest of the equipment is the same, drops of water on greasy surface, smelling stale and looking dull. Such conditions will create a similar taint in the milk and cream, and the utensils will rust very quickly, thus bringing nearer the day of necessary replacement, because the utensils were not properly scalded. The result is that germs, invisible enemies which spoil dairy products, have not been destroyed, but given another lease of life.

On the dairy farm, germs obtain access to milk, cream and utensils from the dust of the cowyards, dust and manure from the cows' flanks, udder and tail, from dusty hay, cobwebs and many other sources. The cleaner the premises and surroundings, the fewer germs there will be, but even in the cleanest of dairies they are a menace which has to be dealt with. The only means of effectively countering them is by the application of heat, such as boiling water, which, if applied long enough, will destroy practically all organisms.

Germs which spell spoilage for dairy products thrive best and multiply more rapidly at warm temperatures, hence the vital necessity of cooling to a low temperature when their capacity to multiply is arrested. Heat kills them, hence heat and plenty of it should be applied. The greater the heat and the longer it is applied, the better the kill.

Essential Points in Dairy Practice.

Much too frequently in the past, a kerosene tin only of hot water has been used, the water seldom at boiling or even at scalding point, and certainly not possessing a high germ killing efficiency. With such water, utensils cannot be properly cleansed and first or second grade products usually result.

There are many instances where hot water for the dairy has to be carried from the house, sometimes 200 or 300 yards away, and so much of the heat is lost before the water is used. Again, it is not sufficient to cleanse utensils properly in the morning, and to give them a cleanse with cold water at the second milking. If such a practice is continued it will prove disastrous to grading figures.

Since the coming into use of the copper boiler, the use of the kerosene tin is being discontinued. The most progressive dairy farmers have large boilers, holding 20 or more gallons, preferably bricked in and cemented and supplied with a large wooden lid. This should be placed as close to the wash-up troughs as practicable—within a few feet, if convenient—so that the water, which should be bubbling, can be transferred to the wash-up trough immediately and in ample quantity. The boiler should be under cover for if left in the open a sudden shower of rain will rapidly cool the water.

A single 1,000-gallon tank does not provide an adequate supply of water for washing-up purposes—at least two such tanks are necessary.

If practicable, utensils should be cleaned immediately after milking. If there is an unavoidable delay, all equipment should be covered with cold water, until further attention can be given to it. Boiling water or steam should never be applied until all milk fat, dust and dirt have been removed by cleaning in cold or warm water. If boiling water is used first, the albumen of the milk will coagulate on the utensils, thus rendering cleaning more difficult.

After this preliminary washing, all utensils should be immersed in very hot water to which a quantity of washing soda has been added. They should be scrubbed thoroughly with a good stiff brush so that the bristles penetrate every corner and crevice. Cloths should *not* be used. This procedure should be followed by a further immersion in clean water which is really boiling and to which no soda has been added. Care should be taken to wash the outside as well as the inside of all utensils. In many instances, it is the practice to rinse all articles in cold water after the treatment described, but this is condemned because of possible contamination and the fact that they are left wet.

Where a steam sterilizer is available, a final steam treatment should be given. Where this is not possible, the utensils may be kept submerged in boiling water for at least two minutes. They should then be placed on galvanised iron pipe racks, in a clear, dust-free atmosphere, not on sour smelling, unsanitary wooden benches. Some dairy farmers, knowing

that the sun is an effective germ killer, leave their utensils in the sun, but very frequently right beside a dusty cow yard, exposed directly to serious dust contamination. All equipment should be kept well away from the yard and dust, preferably surrounded by concrete, or a well-grassed area and fenced off.

If clean raw milk is put through clean sanitary equipment, a big advance to the standards desired will have been made.

Influence of Purebred Sires on Production.

THE keeping of records and the culling of unprofitable producers, although of high importance in dairy practice, will not alone tend to any great extent towards increasing production. Any attempt to assemble a high producing lot of animals in this particular way without using a purebred sire of undoubted ability may be a waste of time and effort, for productive capacity is a matter of breeding along right lines. Thus the importance of having a purebred sire from a high producing family is plain.

The dairy farmer who is building up a herd with a foundation of common cows should decide what particular breed of cattle he intends to go in for before purchasing his purebred sire. For use in a herd of this description or even in a herd of high grade cows, the sire is best selected on his pedigree and the milk records of his female ancestors, at the same time giving attention to individuality. Our more experienced breeders of purebred dairy cattle have given close attention to pedigree and production and know just how to interpret them in order to gain results with the matings. On the other hand, the dairy farmer who is not familiar with this subject should get someone with the necessary knowledge to assist him in making the selection of a sire for his herd, as far too many mistakes have been made and are still being made, quite unconsciously, by less experienced dairy farmers, simply because they may not understand the principles of animal breeding.

It is stressed, however, that a good pedigree, which includes ancestors with satisfactory records of production, does not necessarily ensure that the sire in view will be a certain transmitter of the desired dairy qualities; for it has been found sometimes that an animal with a great pedigree has not proved successful as a dairy sire. However, a long line of good ancestors is the best indication any dairy farmer can get of the probable value of a bull before he has proved his ability by the production of his heifers, to transmit his inherited qualities, although the buying of a bull by pedigree with the necessary attention to type will usually be found satisfactory.

—L. VERNEY.

NOTICE TO READERS.

Because of the present necessity for strict economy in the use of paper, readers are requested to renew their subscriptions promptly. If renewals are unduly delayed, it may be impossible to supply back numbers of the Journal.

Address all renewals and other correspondence to the Under Secretary, Department of Agriculture and Stock, Brisbane.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock, which have qualified for entry into the Advanced Register of the Herd Book of Australian Illawarra Shorthorn, Jersey, and Ayrshire Societies production records for which have been compiled during the months of January and February, 1944 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORN.				
Mature Cow (Standard 350 lb.)				
Alfa Vale Florrie 3rd	W. H. Thompson, Nanango	13,092·7	570·26	Reward of Fairfield
Rosenthal Perfect 5th	S. Mitchell, Warwick	10,725·19	419·412	Rosenthal Carbene
Braemar Empress	W. Henschell, Yarranlea	10,782·59	393·124	Blacklands Gay Lad
Junior, 4 Years (Standard 310 lb.)				
Brundah Petal	C. O'Sullivan, Greenmount	9,757·65	398·679	Greyleigh Eros
Happy Valley Melba 2nd	R. R. Radel, Coalstoun Lakes	8,170·04	356·137	Sunnyview Artist
Senior, 3 Years (Standard 290 lb.).				
Alfa Vale Sylvia 4th	W. H. Thompson, Nanango	11,747·25	506·706	Penrhos Pansy's Pride
Alfa Vale Laura 5th	W. H. Thompson, Nanango	10,752·15	452·242	Penrhos Pansy's Pride
Junior, 3 Years (Standard 270 lb.).				
Greyleigh Gem 139th (365 days)	W. H. Thompson, Nanango	16,825·2	750·553	Swanlea Bertie
Happy Valley Ada	R. R. Radel, Coalstoun Lakes	6,822·92	329·381	Sunnyview Marvel
Navillus Shannon 6th	C. O'Sullivan, Greenmount	7,374·9	300·023	Greyleigh Eros
Senior, 2 Years (Standard 250 lb.).				
Sunnyview Blossom 5th	W. Henschell, Yarranlea	10,020·47	416·602	Sunnyview Commodore
Jamberoo Winnie 4th	M. J. Brosnan, Headington Hill	10,919·85	413·887	Greyleigh Valiant
Junior, 2 Years (Standard 230 lb.).				
Sunnyview Kitty 7th	W. Henschell, Yarranlea	8,420·81	378·284	Sunnyview Commodore
Happy Valley Sapphire	R. R. Radel, Coalstoun Lakes	7,385·68	323·633	Sunnyview Warden
Jamberoo Marjorie 8th	M. J. Brosnan, Headington Hill	8,296·4	302·194	Valiant of Greyleigh
Happy Valley Lorna	R. R. Radel, Coalstoun Lakes	5,784·39	238·57	Sunnyview Warden
JERSEY.				
Junior, 2 Years (Standard 230 lb.).				
Lermont Heather Bell	J. Schull, Oakey	6,462·3	289·029	Lermont Ambassador
Lermont Fan	J. Schull, Oakey	5,732·1	238·42	Lermont Ambassador
AYRSHIRE.				
Junior, 3 Years (Standard 370 lb.).				
Leafmore Lady Jan	J. P. Ruhle, Motley	5,818·95	277·93	Myola Jellicoe
Junior, 2 Years (Standard 230 lb.).				
Leafmore Deborah 2nd	J. P. Ruhle, Motley	6,231·2	243·907	Myola Jellicoe

The Large White Breed of Pig.

E. J. SHELTON.

THE rise in popular favour of the Large White breed of pig is remarkable for no other breed of pig has achieved such importance in recent years.

It is true that a study of pig production during the past half century suggests the somewhat odd fact, that, while the bacon curer and pork butcher have been increasingly emphatic in their demand for lean meat, they seem to have met with considerable difficulty in getting it. For fifty years in England, bacon curers and others have urged the wider use of the Large White boar in commercial pig production. As long ago as 1887 prominent bacon curers were recommending the Large White breed to farmers; in fact, they went further, and purchased selected boars and distributed them to breeders in different parts of the British Isles.

This persistent demand for lean meat, common also in Queensland, has to a large extent influenced the type of the Large White breed, and in the well-balanced pigs of to-day it is possible to see the value of breed improvement.

The Large White Type.

In outline, the Large White pig resembles the most desirable baconer. The standard of excellence emphasises such important points as length, level back, long and wide quarters, broad and deep hams, light shoulders, a white or pinkish skin free from wrinkles, and a sturdy constitution. Although the value of the Large White for bacon production is now invariably stressed above other characteristics, its usefulness as a general purpose pig is equally significant; many carcase competitions and long experience have testified to this, especially in the Old World. Almost every year since the National Pig Breeders' Association's pork contests, inclusive of bacon weights, were inaugurated, the champion pork carcases at British shows have been of Large White type. Pig meat of all weights can be produced economically from the pure Large White, while British butchers also favour any pig which shows a cross of this popular breed. Experiments have confirmed the belief of established breeders that bacon and pork produced from Large White pigs is of excellent quality and texture.

Breeding Stock.

Large White sows are tractable and good mothers. The ever-increasing number of such sows kept by commercial pig breeders in all parts of the world speaks for itself. Breeders and feeders whose farms

lie in widely different directions and whose management systems are correspondingly varied find the Large White equally suitable. The boars are of very adaptable type and are specially recommended.

Hardiness.

A breed that is able to thrive in Finland, Russia, and Northern Scandinavia where the cold is intense, and in South Africa, India, Australia and the Malay States, where the thermometer rises beyond any temperature recorded in England, is hardy enough surely.

Carcase Quality.

One of the advantages claimed for the Large White is that when dressing the carcase, the skin is very white and clean; also butchers and curers are not afraid of "seedy cut" nor of the general appearance of the carcase. Time and labour and greater satisfaction results in cleaning and otherwise endeavouring to satisfy discriminating popular taste.

Availability.

Great Britain is still regarded the world over as the stud farm of the world. British-bred Large Whites have been exported in large numbers during the past century, more especially since pig production developed into the economic importance which it has attained to-day. They are now available in large numbers and of better quality than ever before and the demand, particularly in Australia, is increasing.

The Large White breed also has had remarkable successes in the show ring, both in the live animal and in carcase form. The breed has gained much success in the dairy show bacon contest in London, at the Birmingham Fat Stock Show, at the Smithfield Show, and at many other bacon competitions. In Queensland, the Large White is numerously represented in the stud books. Breeders are realising that they are a safe as well as satisfactory breed.

Care and attention to prevent skin troubles within the Large White breed needs, however, to be stressed, and it is essential that for pigs of the breed ample shade and protection from the effects of severe weather should be provided. Particular attention also should be paid to the selection of strains adaptable to the warmer regions of the State. Given this added care and protection and suitable strains of the breed, there is no reason why the Large White should not continue to increase in importance in the Queensland pig industry.

SOAKING AND GRINDING MAIZE FOR PIGS.

The effect of different degrees of grinding on the digestibilitiy of maize meal and the effect of soaking in water on the digestibility of maize cobs were investigated at an overseas research station. A medium degree of grinding (that is, a coarse meal) was most satisfactory. Soaking reduced the digestibility of maize cobs, apparently because the pigs swallowed them in large pieces instead of masticating them thoroughly.

Mixing cereal meals with water immediately before feeding did not influence their digestibility, but they were somewhat more appetising than in the dry state, so food consumption, and in consequence, rate of live weight gain was increased.

The efficiency of meal conversion was, however, somewhat impaired, suggesting that the feeding of meal in dry form, suitably balanced with a protein-rich concentrate plus mineral, is sound practice.

A Model Piggery Layout.

E. J. SHELTON.

FINDING that the disposal of the food scraps from a large military convalescent camp in Queensland through the usual channels was not—to the camp—a profitable venture, the Commanding Officer of 102 Aust. Con. Depot, Col. H. M. Saxby, decided to enlist the services of one of his senior officers, Major F. B. Common, in an investigation of the possibilities of the camp conducting its own pig farm.

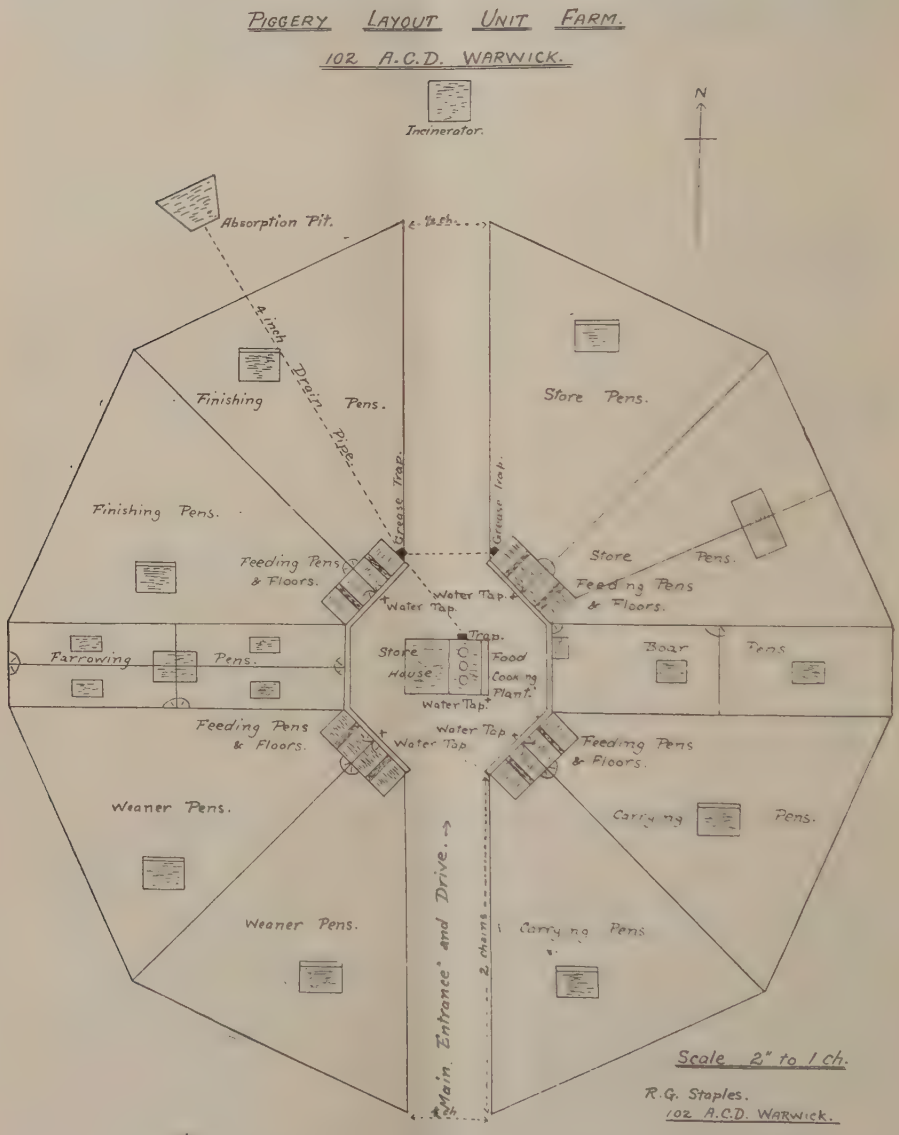


Plate 113.

An additional area of cultivation land being available nearby, this area was added to that then occupied and the farm now consists of 68 acres of land varying from rich lucerne flats to upland grazing areas. Fig. 1 shows the general plan adopted, inclusive of the necessary equipment for boiling refuse food scraps.

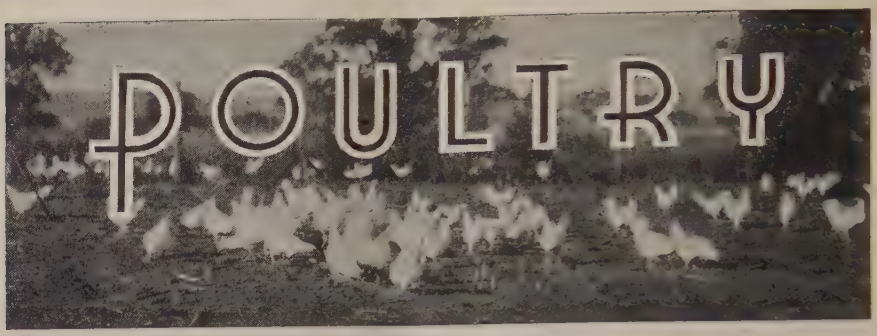
The choice of a breed fell on the Canadian-type Berkshire, popular in the district, and animals of first quality were secured as foundation breeding stock. The next move was the registration of the "Depot" Stud as members of the Australian Stud Pig Breeders' Society and entering up of the breeding stock as the camp property.

Speaking of the objectives, it is worthy of note that these include the production of quality stock and products through the provision within the camp itself of an economical and profitable market outlet for all food scrap and such farm products as could be grown—viz., lucerne, oats, root crops, &c. The aim also is to provide for soldiers convalescing at the camp an interesting and helpful—withal profitable—phase of agriculture, in this case pig raising; and the provision of practical educational and working facilities through which those who are interested may gain more than a passing insight into the many and important phases of pig production about which there is a great deal more to learn than is usually understood.

The venture is as yet in its initial stages, hence no statement regarding financial returns is available, but the fact that there has been judicious expenditure on foundation stock and equipment augurs well for the achievement of the promoter's object of making the stud a practical, profitable, and useful addition to the Depot's equipment.

SALT FOR PIGS.

Coarse salt mixed in the food given to pigs is harmful only when fed in excess. In Departmental tests to determine whether salt has any toxic (poisonous) effect increasing amounts of salt up to 2½ ounces per day were fed to pigs without any harmful results, and the animals gained weight normally under conditions to which they had gradually become accustomed (from a few grains only per day up to 2½ ounces per day per pig), and where they had free access to clean drinking water. If the salt had been fed in increasing amounts without continuous access to drinking water, or if the maximum amount had suddenly been added to the food in one dose, results may have been disastrous. Cases of pig poisoning due to excess of salt are rare and are invariably due to accidental causes, such as when pigs have access to salted hides or skins, or where they are compelled to eat food mixed with water carrying excess of salt (brackish water). The addition regularly, daily, of small quantities of salt to the food is recommended in preference to periodical doses excessive in quantity, or none at all. Minerals are necessary, and may be used in the form of bone meal, charcoal, wood ashes, or commercial mineral mixtures containing these and other mineral matter. All commercial stock foods carry a small percentage of salt to make them more appetising.



Incubation.

P. RUMBALL.

INCUBATION may be successfully practised throughout the year, but more satisfactory results are obtained after the moulting period, which is usually over by June. The demand for eggs to-day is so extensive and the need so great that hatching is justifiable at any time to fulfil this need.

During the hatching season of 1943 there were many reports, particularly at the commencement of the season, of poor results. These poor results were not due to the lack of fertility, but to dead-in-shell. Incorrect operation of incubators can be responsible for much of this trouble, but it is not likely to be the case with experienced operators working old and tried machines. The trouble last year was undoubtedly due in most cases to defective nutrition. The feeding of the breeding stock has a most important influence on hatching. The feeding of the breeders does not end with the hatching of the chicken. Incorrect feeding also has its effect on the rearing of the chickens.

The fodder supply position this year is no better than it was last year. There appears little or no prospect of the availability of fish oil for breeding stock, and as the bulk of the ration will consist of white grain the shortage of vitamin A must be provided for. The only source of this vitamin that appears available is green feed, choice lucerne chaff, and probably some maize. Some of each, if practicable, is advocated. All the green feed the birds will eat should be provided. If it is necessary to use lucerne only, it should be of the best possible quality, the fresher the better. If a white grain mash is fed because lucerne (or any other green feed) is unavailable, all yellow maize should be fed as grain.

Selecting Eggs for Hatching.

Care in the selection of eggs which are to produce the future layers and breeding stock is essential. They should be selected for size, shape, texture of shell, and colour.

Although like does not produce like with any degree of certainty, constant selection generation after generation will tend to fix the qualities desired. Size is undoubtedly an inherited quality, and one of the factors which have an important bearing on profitable poultry raising. Birds should be selected for breeding purposes for egg size early in life for it is only by this means that a strain that will lay early in their pullet year eggs that may be graded for size as first quality can be developed. Eggs vary in size from day to day. This variation

may exceed a quarter of an ounce in the course of the sequence of production. Therefore, in selecting for size, it is not just enough to note whether a bird lays a 2-ounce egg on one day, but to observe the size of egg she lays on consecutive days of each sequence for, say, a month. As in breeding there is a tendency for reversion, it is better to select hens for breeding purposes which lay eggs averaging 26 ounces to the dozen than those averaging barely 24 ounces to the dozen.

Although shape does not materially affect the market value of eggs, a uniformity is desirable. Some eggs may be short and thick in shape, others too long. The happy medium fits egg containers much better and is marketed with less damage. Misshapen eggs are invariably poor hatchers, and therefore should be rejected. In table type incubators, the heat is radiated from above the eggs—the greater the distance from the source of heat the lower the temperature. In some table top machines, the difference between the temperatures one inch above and one inch below the egg tray may be as much as six degrees. As the embryo always moves to the uppermost portion of the egg, eggs of various sizes lying on the egg tray are therefore subjected to varying degrees of temperature with a consequent uneven hatching.

Texture of shell varies considerably with feeding and the general condition of the stock. Young birds produce invariably shells of better texture than older birds. Inheritance also influences shell quality, and as the true breeding qualities can only be judged in the older birds, shell texture is an important factor in the selection of eggs for incubation. Apart from this, uniform shell structure makes for improved hatches. Colour of shell is not so important from a hatching point of view, nor does it have any influence on the ultimate value of the egg. Shell colour is a breed characteristic. From light breeds, excepting Dutch breeds, the shell should be white; from heavy breeds selection should be from brown shells. Dark brown shelled eggs are pleasing to the eye, and, although the shell is only the container, selection from dark shelled eggs is usual.

Keeping Eggs for Hatching.

The earlier eggs are set after being laid the better the results. If they are no older than five days, better results would follow than if they were ten days old. It is, however, necessary at times to keep them for longer than five days, and to obtain satisfactory results they should be retained or stored under conditions which will preserve their hatching qualities.

Fertilization of the egg occurs in the oviduct of the hen. Cell division then commences and if the egg were submitted to a constant suitable temperature there would be no arresting of cell division or growth of the embryo. After the egg is laid and becomes cold, cell division is arrested; and it is at this stage that it should be maintained. From experiments it has been found that a temperature slightly under 60 degrees is about the best temperature at which to hold eggs pending incubation, and that germ development becomes active at a temperature of 68 degrees. As before-mentioned, the embryo always comes to the uppermost side of the egg. If the egg is to be held for any considerable time, there is a risk of the embryo sticking to the membrane lining the shell of the egg; to avoid this, the egg should be turned.

Eggs held for incubation should be stored in a room at a temperature not exceeding 60 degrees. The air in the room should be fresh.

sweet, and still. A current of air through the room would cause rapid drying of the moisture content of the eggs.

A good plan is to store eggs in cases fitted with fillers. This protects the eggs to some extent from drying out and facilitates the daily turning of eggs which have to be retained for any length of time, as all that is necessary to turn the eggs is to lay the case every alternate day on a different side.

Period of Incubation.

The period of incubation varies considerably with different species of poultry. The hen takes 21 days. All domestic ducks, excepting the Muscovy, 28 days; the Muscovy, 34 to 35 days; the goose 28 to 30 days; and the turkey, 30 days.

Hen Hatching.

A broody hen will generally find her own nest. She may be left alone, merely protecting her from the weather and preventing other hens from laying in the same nest. At times it may be necessary, because of lack of facilities, to shift her, but this should not be attempted for a few days, and then only at night, for she is less excitable, and more likely to settle down to new quarters. On shifting put one or two of any kind of eggs or artificial eggs under her, until her willingness to use the nest is established. When this is determined the eggs it is desired to hatch may then be placed under her.

Most poultry houses are fitted with wooden nests raised a foot or more about ground level. However desirable otherwise, such a raised nest is not the best type for the broody hen. For a broody hen, a nest should be on the ground and obviously in a dry place protected from drainage and the run of rain water. The nest should consist of a slight hollow in the soil lined with clean straw, or dry grass. Mouldy material should not be used. As the hen is expected to remain on the nest for 3 weeks, leaving it only for feed and water, she will not make free use of a dust bath, consequently body vermin, if present, is likely to multiply. To guard against this, she should be given a dusting with some insect powder before the clutch is placed under her, and another dusting a few days before hatching is due.

Red mite and tropical mite are possibly the most common and irritating blood sucking parasites that trouble poultry. They multiply very rapidly when unchecked, and a sharp lookout should be kept for their presence for, if allowed to infest a broody hen, they frequently cause her to leave her nest. Scaly leg is also a condition to be prevented, especially with a broody hen. The scale is caused by a parasite which may attack the chicken's legs as soon as they are hatched. Not only is scaly leg unsightly, but the parasite is obviously detrimental to the proper development of the young birds. The only protection of the young from scaly leg is to avoid using broody hens affected with the trouble.

The number of eggs that should be set under a hen depends on the size of the hen, which should never have more than she can comfortably cover. A hen turns the eggs she sets upon to prevent the embryo sticking to the membrane lining the shell. She also alters in the nest the position of the eggs. Those on the outside one day may a few days later be in the centre, and the centre eggs on the outside. If a hen is given too many eggs, the outside eggs may not get enough warmth, and in cold weather they may become chilled, and the embryo destroyed.

The constant movement of the eggs may therefore result in the destruction of most of the clutch. Therefore, it is better to give a hen too few than too many.

While a hen is setting she should be fed exclusively on grain and have access to grit and water at all times. She should not be removed from the nest at any time during the incubation period. She will come off when necessary, and if she is going to make good on the job go back to her nest before the eggs get too cold.

EFFECT OF CLIMATE ON DIFFERENT CLASSES OF POULTRY.

Two classes of birds are generally used by commercial poultry farmers—light breeds, such as Leghorns, Anconas and Minorcas; and heavy or dual-purpose breeds, such as Australorps, Wyandottes, and Rhode Island Reds.

Light breeds, as a rule, are of a "highly strung" nature, and are very susceptible to climatic changes, particularly during the early periods of production. Rains and cold snaps will invariably check production with this type of bird. This is particularly noticeable if the birds are not housed under the intensive system. If false moults are to be avoided, the highly strung nature of the birds also makes it inadvisable to alter their location until they have settled well into production and until spring approaches. If, for any reason, light breeds have to be handled before, say, the middle of July, go about the work quietly and, if at all possible, work only in the afternoon, for most of the birds to lay on that day will have done so by then.

The dual-purpose breeds, on the other hand, are more docile and quiet. They are not so easily disturbed by climatic changes during the early laying stages, but are more susceptible to heat, as many dual-purpose birds lay on fat. Greater liberties can be taken with dual-purpose breeds in relation to change of quarters, but do not worry them or shift them during early winter, as they are not immune from false moults.

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ANIMAL HEALTH

Tick Fever of Poultry.

TICK fever* is a highly fatal disease of poultry, ducks and geese, caused by a microscopic spiral-shaped organism called a spirochaete. The disease has been reported from nearly all over Queensland, its distribution following closely that of the poultry tick which is the chief factor in spreading the disease. Although an important disease of commercial flocks in earlier years, outbreaks are now confined mainly to backyard and farm flocks where no precautions are taken to control ticks.

Transmission.—The disease is not contagious in the ordinary way, but is dependent on blood sucking parasites, such as ticks and mites, for its spread from bird to bird. Ticks are the most important means of transmission because of their wide distribution, difficulty in eradication, and also because the organisms can multiply in the body of the tick which may harbour them for several months.

Symptoms.—In very severe outbreaks, deaths may occur before symptoms show. Generally, however, the affected birds are dull and stand or sit with closed eyes, ruffled feathers, and the head held low or drawn into the body. The skin and comb may be dark and withered, or sometimes pale. A high fever, the temperature rising to 110 deg. to 112 deg, greenish-yellow diarrhoea, leg weakness and later paralysis are characteristic of this disease.

Post-mortem Appearance.—The most constant and typical finding after death is a greatly enlarged spleen. Normally the size of a hazel nut, this organ may be swollen to the size of a peach and is flecked with greyish spots. The liver is usually congested and may show flecking similar to that of the spleen. In some cases, the tissues, particularly of the liver, have a yellowish or jaundiced appearance caused by the breaking down of the red blood cells by the spirochaetes.

Mortality.—Up to 80 per cent. mortality may occur, heaviest losses being found among young birds which appear to suffer more severely than old ones. Deaths usually continue over a period of two to three weeks, after which the remaining birds develop a strong resistance to further infection. After recovery, a few birds may become anaemic, waste away, and eventually die.

Diagnosis.—When a number of birds die after showing the symptoms described, it is advisable to take the temperatures of a few sick ones to determine whether fever is present. Blood smears should then be taken from two or three of those with the highest temperatures and sent to the Animal Health Station, Yeerongpilly, for examination. The organism may be found by microscopic examination of suitably stained blood smears, thus confirming the diagnosis.

* *Spirochaetosis.*

Smears are prepared by cutting a spike of the comb with scissors or pricking a vein beneath a wing with a needle and smearing a small drop of blood on to a glass slide (any piece of flat glass about 1 by 3 inches is suitable). The smear is allowed to dry, the slide wrapped in paper, packed in a small tobacco tin, and sent to the laboratory with a covering letter giving details of the sickness. As an alternative, a live bird showing typical symptoms may be sent for examination, but care should be taken to select a bird which is expected to live until arrival, as birds dead for more than a few hours are unsuitable.

Treatment and Control.—Tick fever can be treated successfully with organic arsenical compounds—e.g., mapharsan—but the cost of these drugs is rather high and they require careful injection hypodermically into the muscles, thus precluding their general use. The disease can be controlled effectively, however, by eradicating the carrier parasites. To do this, it is necessary to have some knowledge of the life cycle and habits of the parasites which carry the disease, and the following outline of their life is therefore given:—

The Poultry Tick.

Adult ticks feed only at night and shelter during the day in cracks and crevices in the woodwork of poultry houses, under litter and rubbish, or even in the bark of trees. Thus an examination of the fowls during the day may not reveal ticks, even though they may be present in great numbers.

The adult female tick deposits its eggs in a sheltered position and may lay up to 900 in several batches during its lifetime. Under favourable conditions, the eggs hatch in ten to fifteen days, and the small larval ticks which emerge have only six legs. They attach to the host and can be seen as bluish specks about the size of a pin's head clinging to the breast, neck, and wings and thighs. In three to nineteen days they leave the fowl, seek a sheltered spot and moult, appearing again as an eight-legged nymph, which, like the adult, feeds only at night. After two further moults, the adult stage is reached.

Control.—Fowl ticks are difficult to control because they resist ordinary insecticides and their habit of sheltering in deep cracks makes effective application of sprays uncertain. Moreover, the mature ticks are able to live for at least four years in an empty fowlhouse, so that vacating the pens in an attempt to starve out the pest is not practicable.

The most suitable sprays are crude oil, creosote or kerosene emulsion. The latter is cheap and kerosene is available in most households. To prepare it, boil 1 lb. of soft soap in 1 gallon rain water until dissolved. Remove from the fire and stir in 1 gallon of kerosene. This stock is then diluted with 8 gallons of rain water before use.

Before spraying, all nesting straw and litter in which ticks might hide should be removed and burnt. The spray should be applied hot and forced well into cracks and crevices. Treatment should be repeated at three-weekly intervals until no more ticks are seen, and thereafter every three months.

Perches should be turned over and, with nest boxes, treated at each spraying. To prevent the eggs developing foreign flavours, new nests should be provided until the odour of the spraying material is no longer present.

It is very difficult to get the ticks out of old houses and, perhaps, the most effective way is to burn the building and erect a new one on a fresh site.

Fowl houses built of sawn timber and iron have the advantage of providing fewer hiding places for parasites, besides being easier to spray effectively.

When the poultry are moved to new quarters, they should first be treated with carbolised vaseline about the neck and breast after examining them for larval ticks, or dipped in solutions of 2 per cent. formalin or nicotine sulphate, or dusted with derris powder.

Special coops should be kept for introduced stock which should be isolated for at least twenty-four days before being placed with the other birds. These coops should be sprayed regularly.

Red Mite.—This mite is much smaller than the tick, being about the size of a pin's head, but like the tick feeds only at night. It is seldom found on birds during the day, except perhaps on broody hens. It lays its eggs in crevices in which it hides and the life cycle requires one to two weeks. The adult can live several months away from the host.

Control methods as applied for ticks give very good results, as this parasite is not so difficult to control.

CARE OF THE CATTLE DIP.

In the course of time a dipping vat will accumulate a considerable quantity of filth, which settles slowly on to the bottom as a deposit of sludge. It may become so bad that an owner is forced to empty the vat and is then put to the expense of recharging.

This can be avoided by cleaning the vat periodically. For this purpose, a kerosene tin is cut in half diagonally to make a scoop, which is attached to a handle with wire. Small holes are cut in the bottom and sides. After dipping cattle, the surface of the fluid may be skimmed with the scoop and floating hair and dirt removed. This helps to keep the vat clean for a long time. After dipping the sump should also be cleaned and dirt prevented from accumulating.

A white mark should be placed on the side of the vat to show the height of the fluid. It will be noticed, particularly in hot weather, that evaporation is very rapid and that the surface of the fluid will fall far below this mark. Before next dipping, water may be added until the dipping fluid is again at the correct level. It is only the water that evaporates—not the concentrates.

CHAFF IN THE EYE.

For horses to get chaff in their eyes is a common experience. To try to remove the chaff by blowing sugar into the horse's eye is both cruel and risky. Castor oil (as used as a medicine) is much better. All that is necessary is to place the oil in the horse's eye night and morning until the condition is remedied. The horse may continue to be worked under this treatment. A bottle of castor oil should always be kept in a handy place.

FARM ECONOMICS

Farm Management.

C. H. DEFRIES, Instructor in Agriculture.

ON the average farm the farmer himself performs all or most of the functions of organiser, works manager, supervisor, worker, office manager and salesman. In a factory of any size these functions are allotted to different men according to their special abilities. The consequences of the absence of specialisation are that farming becomes not only a more complex job than many others and that the farmer himself tends to think of his variety of tasks as just "farming." The special problems of each of the functions he has to perform in some measure or other are not kept to the forefront as they are in a factory, where the existence of several departments give rise to its own problem of co-ordination of effort. The problem on the farm is rather that of the recognition of the several phases of farming, so that they are in fact recognised as quite distinct functions. This applies particularly to the function of management.

Farm Management.

Successful farming depends on many diverse factors, not the least of which is the capacity of the farmer himself; but no matter how capably a farm is run, attention to the fundamentals of management would be conducive to even more satisfactory results. The two requirements of management on a farm are, first, the construction of a system of records, and, second, the capacity to interpret the meaning of the information derived from the records and to use it in running the farm.

The records kept on the typical family farm are usually not very comprehensive, even if they exist at all, and many farmers in fact do no more than retain cheque butts, dockets, accounts, and account sales; that is, the barest minimum required for the purpose of making out income tax returns. Most men on the land are inclined by the very nature of their calling to keep to the minimum the amount of time they spend on clerical work, unless there is some immediately obvious reason why they should do otherwise. This attitude is easily understood, especially at the present time, when the most pressing problem on many farms is that of finding enough labour and time for the ordinary daily routine. It is none the less a mistaken attitude. While it may seem paradoxical to urge action requiring some, if only a little, of a farmer's time during a period of labour and other shortages, it is for this very reason that records assume an importance greater than they would have in normal times. Under our present conditions, it is imperative that the most effective use possible be made of the labour, machinery, and other available resources, and records giving information as to the labour hours, machine hours, tractor hours, and so on required for various farm operations and crops could make a very real contribution to this end.

The Value of a Farm Record System.

The keeping of records does not imply the use of the double entry system of bookkeeping. This has a place on the larger farms, plantations, or stations where it is economical to employ an accountant or bookkeeper, but for the average farmer its value does not warrant the time and trouble necessary for the system to be properly followed through. Usually it is too elaborate for the special needs of the farmer unless it is supervised and done by accountants, perhaps on a farm co-operative basis. Until some such procedure is elaborated—and it has been done quite successfully in other countries—it is the farmer who has to keep his own records and the problem confronting him is precisely what is the minimum of records which should be preserved in order to provide information useful for planning the farm operations. To reduce the work as much as possible, it is suggested that—apart from special types of records, such as milk testing data, milk or egg laying records—there are two types of records which should be kept by every farmer, even if he has no assistance from any organisation and has to rely on his own unaided efforts. They are the farm diary, with which this article is chiefly concerned, and the farm inventory, which is, of course, a list of the farm assets and their value.

The Farm Diary.

A very useful type of farm diary book is one with one day to the page and with two sets of £ s. d. columns on the righ-hand side. These may, of course, be ruled by the farmer himself if necessary on a foolscap-size diary. The most troublesome difficulty will be to know what to include and what to omit. If an attempt is made to overload the book with too much detail, it becomes too difficult to analyse and is therefore useless. If more elaborate records are required, a diary is only a useful supplement to them; but, notwithstanding the fact that optimum value from recording farm data would doubtless require more complete records, reference at present is being made only to the minimum of records which it is desirable should be kept on every farm.

Broadly speaking, two courses are available. One is to keep a general record which would provide a fairly complete picture of the financial transactions of the year and the work done on the farm in a readily available form. This is particularly useful where there is one major enterprise on the property, e.g., dairying or wheat-growing, but if the system is more diversified it is perhaps desirable to have some means of keeping the records relating to each section of the farm distinct, even if only to assist in their interpretation, otherwise the diary becomes too cumbersome. In some cases this could of course be accomplished by dividing each page into three parts, one for general records and the other two for two main sections of the farm.

Another alternative is to crystallise the recorded data around one or two of the most prominent problems which confront the farmer on his particular farm. Such problems exist on any property. They may be peculiar to the individual, common to the district in which he is farming, or even to the industry in which he is engaged. Whether it pays to have work done by contract, the advantages of horses and tractor, the continued production of a crop or a sideline which seems to be on the margin of profit, the requirements of new crops as regards labour, materials, and machinery, or suggested new methods of handling crops, are all matters in regard to which it would be advantageous to keep records which would assist judgment.

To return to the general information which might be entered in the farm diary, the following matters are well worth inclusion:—

1. Weather data, such as daily rainfall, excessive high or low temperatures, the first and last frosts of the season, and notes indicating the number of days in the year on which the soil was unworkable, would be of great value to the crop farmer.

2. The receipts and expenses of the farm. All cash payments to be entered on the day on which they are made, and similarly with receipts.

3. A note of the date of consignment of produce and of the farm purchases.

4. The details of the type of work done during the day and the implements used.

5. Any special information that might be of future interest, such as the incidence of disease among stock, deaths, and the occurrence of pest and disease in crops.

6. The quantity of seed and fertilizer used on crops.

The Use of the Farm Diary.

Nothing has been said so far about costs of production. Far more data is required for this than is provided for in a simple diary, although it is possible by comparing the total receipts with total expenditure to find out the financial structure of the farm as a whole, provided an inventory is made up at the conclusion of the year. The major uses of the diary can be summed up as follows:—

1. It gives a summary of weather conditions through the years that could be of value when planning the optimum use of labour and machinery, particularly if information such as the number of days in the course of the year in which it is usually impossible to use implements is included.

2. The amount of time spent on work of an overhead nature can be compared more accurately with that spent on actual production. For instance, the buildings may need repair, fences have to be erected or repaired, machinery overhauled or repaired, or some time spent on the actual transaction of business. Very few farmers know just what time is occupied in this sort of work compared with time spent on actual production operations, ploughing, and so on.

3. If regular records are kept of costs and time in use, decisions as to whether a new tractor or implement should be bought are more accurately made and, at a time like the present, when it is necessary to bring forth cogent arguments to obtain tractors and engines, information of this nature would be helpful both to the farmer and to the authorities.

4. A record is kept of any special outlay on feed for stock, the price received for farm produce, the dates when operations were commenced and concluded, the dates of sowing crops, and matters of interest not only for the year in which the diary is kept, but also for future reference.

5. It provides a record of receipts and expenses from which it is possible to find out the financial position of the farm as a whole, and the amount left to provide for depreciation, interest, and the farmer's net income.

Obviously, as mentioned previously, the value of these records is limited, and if it is desired to have a fairly complete analysis of the farm business then far more time and trouble is involved than visualised here. None the less, permanent records are so rare on farms that it

seems worth while to urge even the simplest of recording systems in the hope that once their value is realised there will be more inclination toward the more elaborate types of records, at least on some farms.

In farming, more than in any other business, no matter how complete the records are there is always something which will crop up and upset the most valid of judgments. It is this fact that so often prevents a farmer from paying any attention to this type of work, but it is none the less true that the good farmer is the one who can profit most by experience, and he is on surer ground when thinking about his experience if he has it recorded in permanent form so that the facts can be referred to and verified.

It has been suggested that rather than keep general records, a farmer might prefer to concentrate his attention on one particular phase of his farming. This attitude is, in fact, fairly common, although it is thought that some general records should always be kept in diary form.

However, illustrations of some of the more commonly encountered problems in the solution of which farm records could be used may be useful.

(1) **Contract work.**

One question that is arising now, and certainly will do so to an even greater extent in future years, is whether it is more economical to have some types of farm work done by contract or to have the necessary plant permanently on the farm. The future will see a considerable extension either of contract work or of co-operative use of large plant, and in many cases the advantages of one or the other will be clear. Just as at present such a course is obviously desirable because of shortage of labour and machinery, it will be one means at least by which the smaller farmer can rid himself of the curse of over-capitalisation. Even so, it may be quite useful to know just how obvious the advantage is if only to convince those who do not agree. This can only be accomplished by figures which would show the actual hours the owned plant is in use, together with the expenses incurred in using it, and this would permit each farmer to compare the cost of the contract job and his own expenses, including, of course, depreciation and interest on investment. There is always some advantage in owning plant—cultivation machinery or harvesting machinery, for example, can then be used just when it is most appropriately required—but where a farmer is likely to be confronted with this problem in the future, the only sound basis on which to make up his mind on the matter is to know the difference in cost between the two methods. If it is great enough it will outweigh the superiority of ownership; if not, then other considerations might come into operation. The main thing is to know not that one is cheaper or dearer than the other, but to what extent.

Information necessary for this purpose may be entered into a diary, or two simple record sheets might be used; one to show the expenses incurred in performing the work on the farm during the year and the other to show the dates on which the machinery is used and the time during which it is used. The cost of operation per hour or per acre can then be calculated without much difficulty.

(2) **Semi-Permanent Assets.**

Another type of problem inevitable during a time of labour shortage is the need to decide between the use of available resources for the maintenance of semi-permanent assets, and their use for the production of annual crops. This is of particular concern to an orchardist, who

has a semi-permanent asset in the form of fruit trees which, while they may continue to bear, will none the less deteriorate rapidly unless adequate attention—such as spraying and cultural operations—is given them. However, it may be desired to divert some of the labour and machinery of the orchard to the production of vegetables and, while the immediate gains may be attractive, if they are obtained at the cost of the deterioration of the orchard their ultimate value is problematical. Data which would show what labour hours and other resources are necessary for the normal maintenance of the fruit trees would, in such circumstances, be of great value, and would help to avoid mistakes of this nature which have, to the writer's knowledge, been made. Even if little is known about the requirements of the vegetable crop grown, records kept for the first season would be some guide as to the extent to which it is safe to commit the available labour, &c., to crop production, rather than maintenance work. The converse of this reasoning is also worth mentioning. From fear of allowing deterioration in the orchard, there may be a disinclination to grow other crops in the absence of information which would provide a basis on which to judge how the resources of the farm should be apportioned. This, again, will result in financial loss.

(3) **New Crops.**

Arguments similar to those outlined apply to the farmer who is engaged on the production of crops new to his farm and perhaps to the district. Records of labour, machinery, and materials used cannot fail to assist in deciding whether to expand production of the new enterprise at the expense of the normal cropping system. This is particularly relevant to such crops as vegetables which are being grown for the first time on many farms. It is just as easy to miss opportunities for profitable production as to attempt too much and find that some part of the programme has to be neglected. Seasons differ certainly and the results of one will not be duplicated exactly in the next, but the amount of work needed to keep the required information is so small that, rough guide though it is, the balance of advantage definitely rests with a system of records.

(4) **Doubtful Enterprises.**

On many farms, especially if production is diversified, there may be one particular enterprise or crop which is, or appears to be, either a loss or on the margin between profit and loss. In such a case, it might be useful to concentrate attention on this particular crop for a season and keep as complete a record as possible of all the relevant particulars in connection with it as a means of providing a basis for judgment. Thus a particular point would be made of entering in the diary all of the expenses incurred in the enterprise, together with the time spent on it. As this does not provide for the apportionment of overhead charges or joint costs, the aim is not to arrive at the ultimate cost of production so much as to obtain a rough guide to the possibility of replacing one enterprise by another which can be fitted into the farm system. It is sufficient for this purpose to regard the farm overhead as fixed.

The essential feature in which the type of record outlined is of value to the farmer is that instead of relying solely on general impressions, he has some factual data which can be used as a criterion between one course of action and another. The information he obtains in this way is not a substitute for judgment, but is a guide which is far too often neglected, and while in farming blue prints of the future may not be practicable, a few minutes spent each day on keeping track of essential information will prevent many errors and avoid much waste and inefficiency.

Knots to Know

WATER BOWLINE.

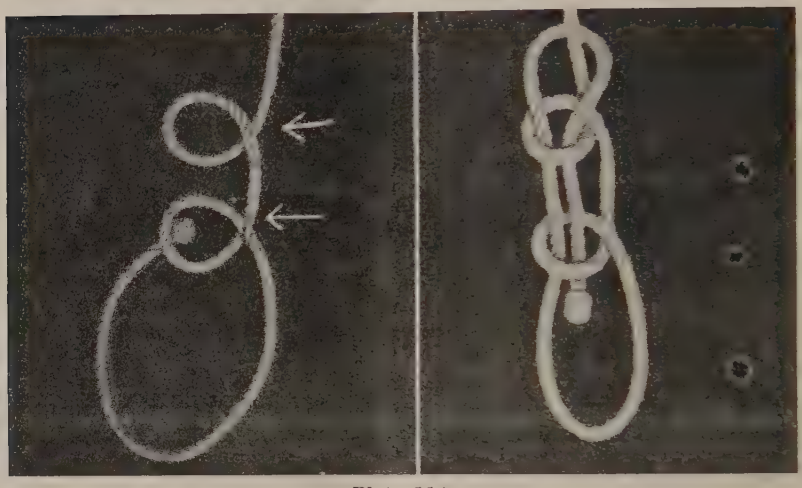


Plate 114.

Left—WATER BOWLINE.—Showing method of tying. Right—Completed knot.

This knot is perfectly secure and will not slip under any conditions. It consists merely of a loop with a bowline below, and is made with two loops (see Plate 114), one above and one below, the short end being threaded through as in a bowline. The great advantage of this knot lies in the ease with which it can be undone when wet. This makes it particularly suitable for use under water.

BOWLINE ON A BIGHT.

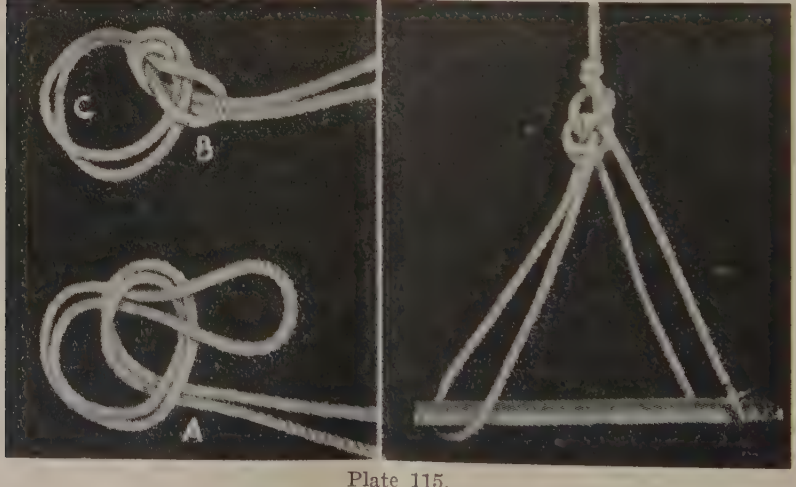


Plate 115.

Left—BOWLINE ON A BIGHT: Fig. A—Method of tying; Fig. B—Completed knot. Right—Bosun's chair ready for use.

Bowline on a Bight (Bosun's Chair).—This knot is sometimes used as a working cradle by painters, and is also used as the foundation knot in arranging a rope harness for throwing horses.

It can be made quite simply by first making an overhand knot as in Plate 115 (Fig. A), and then pulling the ends through the loops as in Fig. B.

If the double rope loop "C" is then spread out to form two single rope loops, it can be used as the bosun's chair (see Plate 115, right).

The bosun's chair can be easily made by doubling the rope and making an ordinary bowline knot.

Used for throwing horses, the double loop is passed over the horse's neck to rest on the shoulders, and the two single ends are led off between the front legs, round the hind feet, and back through at the shoulder. When the ends are pulled the animal is brought gently to the ground, and the hind legs are then held by hitching them with the ropes.

HAY KNOT.

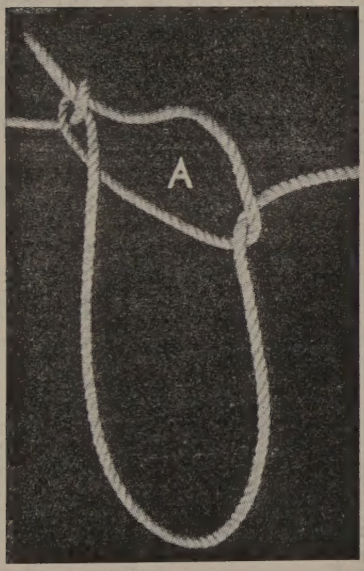


Plate 116.
Hay Knot.

Plate 117.
Hay Knot in Use.

This knot will be found extremely useful for lashing a load on a wagon, and for those engaged in carrying work it is indeed indispensable, as it can be used for roping round a load or over it with equal facility. Its use gives a mechanical advantage of nearly two to one, and the strain can be easily held while the finishing hitch is made secure.

To make the knot reach up with the left hand and make a single loop at a suitable height (Fig. A). Then with the right hand double the slack of the rope into a loop, and pass this through loop (Fig. A) as shown in Plate 116. Still holding an easy strain, the free end of the rope is led round a ring bolt in the wagon and back through the loop (Plate 117, Fig. B), which acts as a pulley and provides a purchase for tightening up the load. The knot is secured by a hitch. While this knot will never slip in normal use, it can be made proof against accident by a half hitch of the upper loop round the rope. This prevents any risk of the upper loop being inadvertently pushed through the hitch.

GADGETS AND WRINKLES

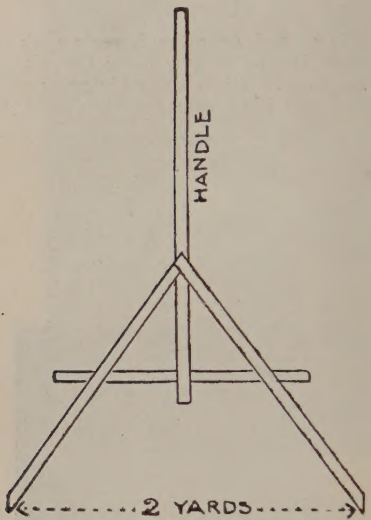


Plate 118.

RAPID LAND MEASURE.

A speedy and accurate land measure is illustrated in the adjoining sketch. To use it, catch hold of the handle with both hands, and turn the measure round and round, keeping one leg on the ground each time. Measuring may be done as fast as a man can walk. The contrivance is particularly useful for marking out lands for ploughing. A good strong light one can be made from slats from binder canvases.

A SIMPLE BIRD SCARE.

Here is a simple and efficient bird scare: It consists of an ordinary post with an arm fastened to it at a right angle. From the arm, suspended on wire are bright tin shingles or other strips of bright metal. When the sun is shining or the wind blowing, the glitter and rattle of the suspended tin plates will scare birds away from the growing crop.

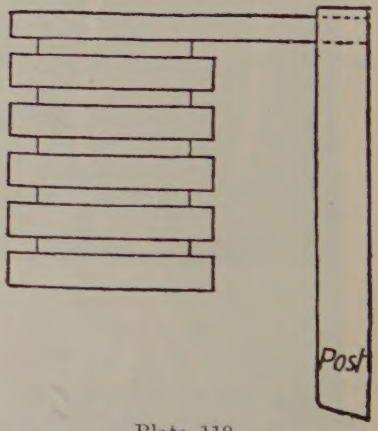
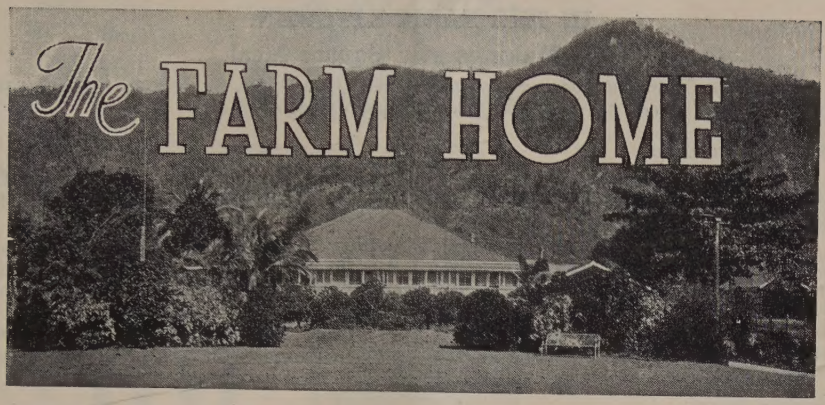


Plate 119.

Care of Tools.

Many hand tools are not now being made. Some are being made of lower grade steel, for example, than before the war. Files are in the latter category, but are difficult to obtain. Therefore, care in handling and storing is essential. The division of agricultural engineering, Univ. of California, suggests that files be kept clean of filings, brass, and particularly of wood particles because the latter will draw moisture and cause rust. A few minutes boiling in water will loosen the wood particles, but metal must be scraped out. Store files separately; don't just throw them into the tool box. Never drag a file on the return stroke. Have the surface clean. Use a worn-out file and extra elbow grease for the first work on hard surfaces, saving the sharp file for the major job.



Care of Mother and Child.

Under this heading an article supplied by the Maternal and Child Welfare Service of the Department of Health and Home Affairs, dealing with the welfare and care of mother and child, is published each month.

CHECKING THE DEVELOPMENT OF YOUR TODDLERS.

HOW often do parents say "Prevention is better than cure" and how rarely do they think seriously of what an important part prevention should play in the life of every child.

Doctors have always proclaimed the value of a medical check up at regular intervals for adults, but how much more important is it to maintain a regular medical check of the development of the child of pre-school age—the toddler.

Let us see how this can help in maintaining a toddler in good health. A few days ago a four-year-old child was brought to a suburban health centre with ten of his twenty teeth badly decayed, including all the molars or grinding teeth. Half of the children examined for the first time at this centre have had defective teeth, some so far decayed that they require extraction. This is a tragic state of affairs because loss of the first teeth limits the child's ability to chew his food properly, as well as causing a narrowing of the jaws. Unless the jaws are broad and well developed there will not be enough room for the second teeth to come through and the child will be condemned for life to a spoilt appearance due to protruding or overcrowded teeth, in addition to a spoilt digestion and general ill-health from badly-chewed food and the absorption of poisonous matter from the decayed teeth. Had the doctor in attendance at the Centre been seeing this child at regular intervals, the mother would have been advised long before as to preventive treatment which would have made a great difference to the child's health. What is true of the value of regular inspection in the case of the teeth is equally true in the case of unhealthy conditions of throat and nose, faulty muscular development and posture, small defects of feet and legs, eye defects, and so on. In their early stages those small troubles are amenable to fairly simple treatment, but if allowed to progress they may become permanent or the correction may require surgical treatment on a much more extensive scale.

The Maternal and Child Welfare Centres are intended to deal with the care of the child's health from the time his mother leaves the midwifery hospital with him to the time he goes to school and comes under the care of the School Health Services. Sisters at the Centres will arrange for the toddler to have that very necessary routine medical examination every six months where this is not being done by the parent's own doctor. Height, weight, and diet will be checked; teeth, nose, eyes and throat examined. The children will learn to be proud of being healthy and strong and growing taller and heavier as well as of having good sound teeth. If any defect shows up contact with the doctor or hospital will be made and appropriate treatment arranged for. Toddlers' health centres are not for sick children—they are to help you keep well children well.

Questions on this or any other matter concerning Maternal and Child Welfare will be answered by communicating personally with the *Maternal and Child Welfare Information Bureau*, 184 St. Paul's terrace, Brisbane, or by addressing letters *"Baby Clinic, Brisbane."* These letters need not be stamped.

IN THE FARM KITCHEN.

The Makings of a Square Meal.

In present circumstances, recommendations are subject, of course, to the availability of the ingredients mentioned or of suitable substitutes.

Mulligatawny Soup.

Take 1 quart stock, 1 oz. butter, 2 teaspoonfuls curry-powder, 1 tablespoonful flour, 1 turnip, ½ teaspoonful curry-paste. 1 oz. ham, 1 onion, lemon juice to taste, 1 apple, 1 small carrot.

Peel and cut the onion into rings. Dice ham. Heat the butter in a saucepan. Add onion and ham and fry until brown. Add peeled, sliced apple, scraped, sliced carrot, and diced, peeled turnip. Stir in curry-powder, curry-paste, and stock. Cover. Bring to the boil and simmer very gently for one hour. Rub through a sieve. Thicken with a tablespoonful of flour, mixed until smooth with a little cold water, and stirred very gradually into the soup. Bring to the boil, boil for a few minutes, then serve at once.

Pumpkin Soup.

Take 2 lb. pumpkin, ½ head celery, 1 leek, 2 oz. butter, 1 cupful milk, 1 quart stock, salt, pepper and a little grated nutmeg.

Cut up the leek, pumpkin, and celery, and put them in the boiling stock. Simmer for one hour and rub through a very fine sieve. Re-heat and add milk, salt, pepper, and nutmeg to taste. Put in the butter and serve.

Ragout of Mutton.

Take 1 lb. neck mutton, 1 tablespoonful pearl barley, 1 oz. butter, 1 tablespoonful flour, 1 onion, 1 carrot, sprig of mint, piece celery.

Cut the mutton into neat pieces. Season the flour with salt and pepper, and dip in the meat. Melt the butter in a pan and fry the meat. Cut the vegetables into dice. Put the meat and vegetables in a casserole with the pearl barley. Add a pint of water and cook in the oven for about one and a-half hours.

Kidney Fritters.

Take 3 sheep's kidneys, ¼ lb. flour, 1 egg, 2 tablespoonfuls milk, salt, deep frying fat.

Boil the kidneys for a quarter of an hour. When cold cut in half lengthways. To make the batter put the flour into a basin with a pinch of salt. Mix the well-beaten egg with the milk and pour slowly into the flour, stirring all the time, until a smooth batter is formed. Dip the halves of kidney in the batter, and when well covered fry in the boiling fat until a golden brown.

Grilled Sausages and Cabbage.

Take ½ lb. beef sausages, 1 small cabbage, 1 onion, a little butter, seasoning.

Parboil the cabbage, after it has been well washed. Drain thoroughly. Melt the butter in a casserole and add chopped onion. Cut up the cabbage and cook for half an hour. Grill the sausages, putting these on top, and mix in a small piece of butter. Put on the lid, heat thoroughly in the oven, and serve with mashed potatoes.

Sausage Meat and Potato Cakes.

Take ½ lb. sausages (beef), 1 lb. potatoes, 2 oz. butter, ½ gill milk, flour, stock, seasoning, parsley.

Skin the sausages (this can be easily done by putting them in cold water for a minute or two) and shape into small rolls with flour. Cook in a little stock for twenty minutes. When cold cut into slices and cover each slice with potato that has been mashed with a little butter and milk and seasoned with pepper and salt. Put on a well-greased tin in a hot oven. Bake until brown, then turn so that both sides are brown.

Sausage and Egg Pie.

Bring 1 lb. pork sausages to boil and simmer very gently until they feel quite firm. Allow to cool, then remove skin and cut into dice. In the meantime boil 4 or 5 eggs until hard and cut them into slices. Melt 1 tablespoon butter in a saucepan, add 1 tablespoon flour, cook a little, then add 2 cups milk or white stock. Stir over gas until thickens, then add 1 dessertspoon grated onion, 1 tablespoon each tomato sauce and shredded and fried bacon, 1 cup diced potatoes, sausages, eggs, 1 teaspoon chopped parsley, salt and pepper to taste. Place in a pie-dish and cover with puff pastry and bake in a hot oven for ten minutes, then lower heat and bake for half an hour.

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